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The Economics of Cattle and Meat
Marketing in Ivory Coast - A Summary

by

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Discussion Papers are preliminary materials circulated to stimulate discussion and critical comment. References in publications to Discussion Papers should be cleared with the author to protect the tentative character of these papers.

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THE ECONOMICS OF CATTLE AND MEAT MARKETING IN IVORY COAST -
A SUMMARY

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ABSTRACT

This paper evaluates the economic performance of the cattle and meat marketing system in Ivory Coast, based on 18 months of field research. The paper discusses recent changes in Ivory Coast's pattern of meat supply, the current organization of the cattle and meat trades, the need for improved market infrastructure, and the problems and costs of transporting cattle and meat to and within Ivory Coast. It also discusses determinants of the most profitable location for slaughter, and what the current patterns of cattle and meat prices imply for the financial viability of proposed cattle fattening projects. The paper concludes with a set of policy recommendations. The marketing system was found to be rather efficient given the infrastructure and institutional framework within which it operates. Major improvements in market performance, however, could result from upgrading livestock transportation and market infrastructure and from changing some of the rules under which the cattle and meat trades operate.

SOMMAIRE

Ce document évalue les résultats économiques du système de commercialisation du bétail et de la viande en Côte d'Ivoire, ceux-ci étant basés sur 18 mois de recherches sur le terrain. Il examine également certains changements récents, tels que ceux ayant affecté le schéma de l'approvisionnement en viande, l'organisation actuelle du commerce du bétail et de la viande, le besoin d'une meilleure infrastructure commerciale, et les problèmes et les coûts du transport des bovins et de la viande à l'intérieur et à l'extérieur de la Côte d'Ivoire. Ce rapport aborde ensuite la question cruciale de l'emplacement idéal des centres d'abattage ainsi que les implications du modèle actuel des prix du bétail et de la viande sur la viabilité financière des projets d'embouche envisagés. Enfin, en guise de conclusion, cet ouvrage offre un ensemble de recommandations d'action. L'efficacité du système en place s'avère incontestable étant donné le cadre institutionnel et infrastructure à l'intérieur duquel il opère. Toutefois, toute amélioration du transport des animaux, de l'infrastructure de marché et des règlements le régissant pourrait entraîner des progrès notables du rendement commercial.

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INTRODUCTION

This study examines the organization and recent evolution of the markets for cattle and meat in Ivory Coast, and discusses constraints to expansion of the Ivorian cattle and meat trades. Ivory Coast plays a crucial role in cattle and meat marketing in central West Africa. Relative economic prosperity has resulted in a strong demand for meat, making Ivory Coast an important market for livestock exports from the Sahelian countries, particularly from Mali and Upper Volta. Livestock production traditionally has played a small role in the Ivorian economy, and the country is highly dependent on imports for the bulk of its red meat supply, including over 80 percent of its beef.

With the recent decline in the Ghanaian market for meat, Mali and Upper Volta have become increasingly dependent on Ivory Coast as a market for their livestock exports. In 1970 Ivory Coast bought 60 percent of Mali's cattle exports and 67 percent of Upper Volta's cattle exports; by 1975, it absorbed 83 percent of Mali's cattle exports and 87 percent of Upper Volta's cattle exports (24, pp. 96-7, 150-60; 6, p. 115; 20).¹ Changes in the Ivorian market therefore affect not only the welfare of livestock producers and meat consumers within Ivory Coast, but also the incomes of livestock producers and traders in Mali and Upper Volta, as well as the export earnings and tax revenues of these livestock-exporting countries.

In recent years, the Ivorian market for cattle and meat has changed markedly as a result of the drought in the Sahel and changes in the world beef market. The drought had two long-term effects on the livestock trade in West Africa. First, it reduced the number of animals available in the Sahelian countries for export to the coastal states. The results were higher livestock and meat prices in both the Sahelian and the coastal countries.² Second, donor agencies and the West African governments

¹The numbers in parentheses indicate the references cited. The list of citations is at the end of the study.

²The initial effect of the drought, especially in the Sahel, was to depress livestock prices, as livestock raisers were forced to destock their herds in order to meet their cash needs. This was a short-term effect, however, followed by an increase in prices as the supply of livestock fell.

responded to the losses of livestock suffered during the drought by creating new organizations to coordinate livestock policy and designing new programs aimed at changing the way in which livestock and meat traditionally had been produced and marketed. On the production side, planners tried to encourage regional stratification of livestock, particularly cattle production. Arid Sahelian zones were to be used as breeding areas, with growing out occurring in more humid zones, and final fattening taking place near terminal markets or export zone abattoirs (22, p.i). On the marketing side, livestock markets were rebuilt and equipped with cattle scales and other materiel; modern abattoirs were constructed in the Sahelian states, with the goal of exporting chilled meat to the coastal states; governments encouraged merchants to truck rather than trek their livestock to market, in order to reduce weight losses during shipment and crop damage by trade herds; and inter-African organizations called for widespread reorganization of the professions engaged in livestock and meat marketing. (See, for example, 5.)

In addition to the drought, changes in the world beef market during the mid 1970s had a strong impact on cattle and meat marketing in West Africa, particularly in the coastal states. Traditional meat exporting countries, such as Argentina, faced with increased stocks of meat in 1975, began prospecting for new markets, including West Africa. In 1975 Ivory Coast was faced with a shortage of livestock and meat from its traditional suppliers, the Sahelian countries, and therefore began importing large amounts of frozen beef from overseas. As a result, the share of the Ivorian beef supply made up by imports from non-West African countries grew from 0.3 percent in 1974 to 37.6 percent in 1976.

This study was conducted in order to analyze these recent changes in the Ivorian market for cattle and meat and to identify constraints to expansion of the cattle and meat trades. The study involved analysis of data already collected by agencies of the Ivorian government, as well as collection and analysis of additional data in Abidjan and Bouaké. The research in Ivory Coast upon which this study is based took place between March 1976 and July 1977. The major findings of the study are presented below in seven sections. The first section examines the recent evolution of Ivory Coast's red meat supply, showing the changes that occurred from

1970 through 1976 in domestic livestock production and in imports of livestock and meat. The second section looks at the current organization and functioning of cattle and meat markets in Ivory Coast and discusses whether the current market organization represents a constraint to expansion of the trade. The third section examines the need for improved physical infrastructure for cattle and meat marketing in Ivory Coast. The fourth section describes the problems and costs of transporting cattle in Ivory Coast and discusses the implications of these costs for transportation policy. The fifth section examines the conditions under which it would become more profitable to slaughter cattle in the north (near where they are produced) and ship their carcasses south than to ship the cattle south for slaughter, as is currently done. The sixth section examines variations in cattle and meat prices in Abidjan and Bouaké during 1976-77 and uses these price variations to draw inferences about the nature of the demand for cattle and meat in Ivory Coast; the section then discusses the implications of this pattern of demand for cattle fattening projects in the north. Finally, the seventh section summarizes the major conclusions of the study and makes policy recommendations aimed at improving cattle and meat marketing in Ivory Coast.

THE RECENT EVOLUTION OF IVORY COAST'S RED MEAT SUPPLY¹

The meat Ivory Coast consumes comes from three sources: domestic production, imports of live animals from the Sahelian countries, and imports of chilled and frozen meat. Through 1974, imports of live animals, especially cattle, were by far the most important source of supply. SEDES figures (24, pp. 439-41, 450-52) indicate that in 1970 imports of live animals provided 73 percent of Ivory Coast's total red meat supply and 84

¹The recent evolution of the Ivorian market for red meat and its outlook through 1985 is discussed in detail in a forthcoming report by the author. This report, to be published in 1979, is part of a larger study on livestock and meat marketing in the "central corridor" of West Africa, being conducted by the University of Michigan's Center for Research on Economic Development for the United States Agency for International Development (Contract REDSO/WA 77-105).

percent of its beef supply. Domestic production accounted for 23 percent of the red meat supply and 12 percent of the beef supply, while imports of chilled and frozen meat made up the remaining 4 percent of the red meat supply and 4 percent of the beef supply. Beef was the most widely consumed red meat in the country, accounting for 75 percent of total consumption. Goat meat and mutton made up 20 percent, and pork accounted for the remaining 5 percent.

Figures presented below indicate that the pattern of consumption in 1976 was about the same as in 1970. The pattern of supply, however, had changed radically. In 1976, imports of livestock from the Sahelian countries accounted for only 45 percent of the Ivorian red meat supply. Domestic production made up 26 percent of the total supply, and imports of chilled and frozen meat accounted for 29 percent. Obviously, the Ivorian market for meat changed considerably between 1970 and 1976, as the figures presented below demonstrate.

Domestic Livestock Production

Table 1 shows the small role that livestock production, and particularly cattle production, play in the Ivorian economy. In 1974, total livestock production accounted for only 2.5 percent of Ivory Coast's GDP, with 1.0 percent of this being attributable to red meat production and merely 0.4 percent to cattle production. In contrast, agriculture contributed 28.9 percent of the GDP in 1974 (11, p. 84). For health and economic reasons, there is little tradition of cattle raising in Ivory Coast, and the country has met its meat requirements (especially its beef requirement) by importing live animals from the Sahelian countries, as stated in the introduction.¹

¹Because of the many livestock diseases endemic in the country (e.g., trypanosomiasis, contagious bovine pleuro-pneumonia) and the humid climate of the southern half of the country, Ivory Coast has had a comparative advantage in export crop production over livestock production. The country has found it cheaper to produce and sell export crops and use the receipts to import its meat from its northern neighbors (largely in the form of live animals) than to produce the meat itself.

TABLE 1

ESTIMATED VALUE OF LIVESTOCK PRODUCTION IN IVORY COAST IN 1974
(in millions of CFA F)

	Cattle	Sheep/Goats	Swine	Poultry	Eggs,Milk Hides,etc.	Total
Value	1,560	1,447	1,207	5,260	753	10,227
Percent of GDP	0.4	0.3	0.3	1.3	0.2	2.5

SOURCE: République de Côte d'Ivoire, Ministère du Plan,
La Côte d'Ivoire en chiffres, 84, 149.

Domestic Beef Production.-- Two species of cattle are raised in Ivory Coast -- zebu, or humped cattle (varieties of the species Bos indicus), and taurins, or humpless cattle (varieties of the species Bos taurus). Zebu, which numbered about 115,000 head in 1976, are highly susceptible to trypanosomiasis and other diseases endemic in the humid regions of Ivory Coast. They are therefore raised exclusively in the dryer savanna areas of the north. Taurins raised in Ivory Coast have some resistance to trypanosomiasis and are found throughout the country, although they, too, are concentrated in the north. Three distinct breeds of taurins are raised in Ivory Coast. Baoulés, a type of West African shorthorn, are by far the most numerous, accounting for about 300,000 head. N'dama's, a slightly larger breed, number between 40,000 and 60,000 head, and are concentrated in the northwest of the country, around Odienné. Lagune cattle account for only about 4,500 head. They are extremely small, highly disease resistant cattle found along the coast.

Table 2 presents estimates of Ivory Coast's domestic beef production from 1970 through 1976.¹ Table 2 shows that domestic beef production grew from 4,700 tons in 1970 to 6,923 tons in 1976, an increase of 46 percent, or approximately 6.5 percent per year. One reason for this rapid growth was that many Fulani herders moved their animals into Ivory Coast during

¹For discussion of the data upon which Table 2 is based, see 27, Chapter 1.

TABLE 2

ESTIMATE OF IVORIAN DOMESTIC BEEF PRODUCTION: 1970-76 (tons)

Year	Cattle Population ^a	Off-take Rate	Number Slaughtered	Ave. Carcass Weight	Meat Production (tons)	Edible Offals ^b (tons)	Total (tons)
Taurins							
1970	289,000	10%	28,900	100 kg.	2,890.0	722.5	3,612.5
1971	297,600	"	29,760	"	2,976.0	744.0	3,720.0
1972	306,600	"	30,660	"	3,066.0	766.5	3,832.5
1973	315,800	"	31,580	"	3,158.0	789.5	3,947.5
1974	325,200	"	32,520	"	3,252.0	813.0	4,065.0
1975	335,000	"	33,500	"	3,350.0	837.5	4,187.5
1976	345,000	"	34,500	"	3,450.0	862.5	4,312.5
Zebus							
1970	50,000	12%	6,000	145 kg.	870.0	217.5	1,087.5
1971	70,000	"	8,400	"	1,218.0	304.5	1,522.5
1972	77,000	"	9,240	"	1,339.8	335.0	1,674.8
1973	85,000	"	10,200	"	1,479.0	369.8	1,848.8
1974	105,000	"	12,600	"	1,827.0	456.8	2,283.8
1975	115,000	"	13,800	"	2,001.0	500.3	2,501.3
1976	120,000	"	14,400	"	2,088.0	522.0	2,610.0
Total Production							
1970	339,000		34,900		3,760.0	940.0	4,700.0
1971	367,600		38,160		4,194.0	1,048.5	5,242.5
1972	383,600		39,900		4,405.8	1,101.5	5,507.3
1973	400,800		41,780		4,637.0	1,159.3	5,796.3
1974	430,200		45,120		5,079.0	1,266.8	6,345.8
1975	450,000		47,300		5,351.0	1,377.8	6,728.8
1976	465,000		48,900		5,538.0	1,383.5	6,921.5

NOTES: Based on data from République de Côte-d'Ivoire, Ministère de la Production Animale, and the following assumptions:

a Cattle population:

- 1) Taurins: Based on a population of 335,000 in 1975 and a 3 percent annual growth rate
- 2) Zebus: Figures provided by Ministry of Animal Production

b Edible offals estimated at 25 percent of carcass weight.

Estimates of carcass weights and off-take rates provided by the Ministère de la Production Animale.

the early 1970s to avoid the drought farther north in Mali and Upper Volta. Between 1970 and 1976, the number of zebus in Ivory Coast increased by 140 percent.

Domestic Production of Small Ruminants.-- No solid statistics exist on the number of small ruminants in Ivory Coast. Estimates run from 1.3 million (16), to 1.8 million (15, p. 14). The Planning Ministry estimated there were 1,000,000 sheep and 760,000 goats in the country in 1975, with sheep producing 3,500 tons of meat and edible offals and goats producing 2,000 tons (12). Lacking more accurate statistics, the figures of the Planning Ministry are used in this report.

Domestic Pork Production.-- Pork production in Ivory Coast takes place both in villages and in a few modern pig farms. The official estimate of pork production in 1975 was 5,000 tons, of which 3,600 tons came from traditional village production, and 1,400 tons came from modern pig farms. In contrast to other types of red meat, Ivory Coast is largely self-sufficient in pork, producing 98 percent of its domestic consumption (12, Tables 6, 10).

Game.-- In addition to the red meat production just mentioned, officials estimated the production of game, snails, and other viande de brousse equaled 16,000 tons in 1975 (12, Table 10). One must regard this figure with caution, however, as there are practically no data on which to base such an estimate.

Domestic Production: A Summary.-- Table 3 summarizes Ivory Coast's domestic red meat production in 1975. In 1975 Ivory Coast produced about 17,000 tons of red meat, excluding game, out of a total domestic consumption (excluding game) of roughly 53,000 tons.

TABLE 3

ESTIMATED IVORIAN RED MEAT PRODUCTION IN 1975
(tons of meat and edible offals)

Beef	6,689
Mutton	3,500
Goat Meat	2,000
Pork	5,000
Subtotal	17,189
Game ^a	16,000

SOURCES: Table 1, and text.

^aThe reliability of the figure for game is questionable.

Livestock Imports

Given the low level of domestic livestock production, Ivory Coast has traditionally relied on imports of cattle and small ruminants from the Sahelian countries to provide the bulk of its red meat supply. This section outlines recent changes in the pattern of livestock imports.

Cattle Imports.-- Table 4 presents officially recorded imports of cattle into Ivory Coast from 1965 through 1976. Between 1965 and 1970, officially recorded cattle imports increased steadily, rising from 80,200 to 198,000 head. The annual average rate of increase of recorded cattle imports during this period was 20 percent. Real per capita income was increasing rapidly during this period and undoubtedly was one of the main forces boosting demand for meat, hence cattle. Larger exports from Mali accounted for much of the increase over this period. Mali's share of the market increased from 30.5 percent in 1965 to 65.8 percent in 1969. During the same period, the number of cattle imported from Upper Volta actually fell by about 12,000, and the Voltaic share of the market fell

TABLE 4

OFFICIALLY RECORDED IMPORTS OF CATTLE INTO IVORY COAST: 1965-76

Year	Mali		Mauritania		Upper Volta		Niger		France		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent ^a
1965	24,446	30.5	1,914	2.4	53,828	67.1	10	—	—	—	80,198	100.0
1966	19,996	19.7	37,234	36.6	44,273	43.6	119	0.1	—	—	101,622	100.0
1967	46,063	38.5	16,739	14.0	56,123	46.9	718	0.6	—	—	119,643	100.0
1968	67,836	41.2	16,356	9.9	80,566	48.9	—	—	—	—	164,758	100.0
1969	113,234	65.8	16,908	9.8	41,335	24.0	567	0.3	—	—	172,064	100.0
1970	143,080 ^b	72.1	b	b	51,199	25.8	4,121	2.1	—	—	198,400	100.0
1971	—	—	—	—	—	—	—	—	—	—	175,896	100.0
1972	137,074 ^b	64.5	b	b	73,658	34.7	1,746	0.8	—	—	212,478	100.0
1973	117,942	52.7	29,001	13.0	73,054	32.6	3,938	1.7	—	—	223,935	100.0
1974	123,148	63.6	31,397	16.2	39,084	20.2	—	—	—	—	193,629	100.0
1975	77,065	54.7	5,069	3.6	58,441	41.5	395	0.3	—	—	140,970	100.0
1976	75,851	67.5	830	0.7	35,264	31.4	—	—	369	0.3	112,314	100.0

SOURCE: République de Côte-d'Ivoire, Ministère de la Production Animale, unpublished data; République de Côte-d'Ivoire, Ministère de l'Economie et des Finances, Direction de la Statistique, Situation économique de la Côte-d'Ivoire, various issues; and SEDES, Recueil statistique de la production animale, study done for République Française, Ministère de la Coopération (Paris: 1975), p. 450.

NOTES:

--- Not available

— None or negligible

The Ivorian Ministry of Animal Production accepts the figures published in the Recueil statistique de la production animale as the official figures for years prior to 1972. These figures differ in some years from the figures reported by the Veterinary Service and published in Situation économique de la Côte-d'Ivoire. For 1966 and 1967, these differences are very small; therefore the Veterinary Service's statistics are used, since they give the country of origin of the imported animals, which the SEDES figures for 1966 and 1967 do not. In years where there are large differences between the Veterinary Service's statistics and the SEDES figures, the latter are used. Figures for the years 1973-76 are from unpublished data of the Ministry of Animal Production.

^a Totals may differ slightly from sum of subtotals due to rounding.

^b Figures for Mauritania included in the figures for Mali.

from 67 percent to 24 percent.¹ Much of the recorded increase in Malian exports was probably due to the lifting of Malian exchange controls in 1967 and the reduction in the Malian export tax on cattle in 1969 (28, p. 9). The growth of Malian exports was also tied to the growth of Ivorian cities such as Daloa, Yamoussoukro, San Pedro, and Bouaké, whose meat supply is met by Malian animals transported south on hoof.

In 1971, total recorded imports fell by almost 23,000 head, reflecting the impact of the drought in the Sahel. Faced with increased mortality, Sahelian herders apparently held back animals and tried to maintain their herds. This was followed in 1972 through 1974 by a destocking of herds as the drought became more severe, and herders were obliged to sell even young males and cows to meet their cash needs. This destocking of northern herds is reflected in increased cattle imports into Ivory Coast during 1972-1973, particularly by a sharp increase in imports from Mauritania, where the effects of the drought were severe. The high level of cattle imports into Ivory Coast from Mali during the period 1970-74 was also a by-product of the decline in the Ghanaian market for beef, which resulted from economic instability and the reorganization of the cattle trade in Ghana. Many of the cattle that "normally" would have been exported to Ghana ended up in Ivory Coast during this period.

In 1974, total recorded cattle imports into Ivory Coast fell by 30,000 head from the previous year. The decline in recorded imports continued at an accelerating rate in 1975. Imports fell in 1975 not only because the marketable surplus of animals in the Sahelian countries was reduced by the drought and the subsequent destocking of herds in 1972-74, but also because Mali and Niger closed their borders to livestock exports during part of the year. This did not cut off the trade completely, but it certainly reduced it. Imports were also reduced because of the hostilities between Upper Volta and Mali, which essentially ended the transit of Malian animals through Upper Volta along the route

¹Part of the apparent growth in the Malian share of the market probably reflected an improvement in the statistics gathered along the Mali-Ivory Coast border.

Mopti-San-Bobo-Dioulasso-Ouangolodougou (Ivory Coast). In response to this drop in total cattle imports, the Ivorian government, through its state-owned company AGRIPAC, began importing large amounts of frozen meat, mainly from Europe, in September 1975.

The decline in recorded imports continued in 1976, falling to 112,314 head. Imports continued to fall in 1976 for two reasons. First, the effects of the drought continued to be felt. (Many of the young animals that died in 1969-72 normally would have been marketed in 1976.) Secondly, part of Ivory Coast's "normal" supply of cattle, particularly from Upper Volta, apparently was diverted toward more profitable markets in Niger and Nigeria. The high prices offered in Niger stemmed from two causes: the Nigerien herd reconstitution program, which resulted in high prices being offered for young animals, especially heifers; and the strong demand for slaughter animals in Nigeria.¹ Many Voltaic cattle merchants abandoned the Abidjan market in 1976 to sell their animals at Téra, on the border between Niger and Upper Volta. It thus appears that the Ivorian government's policy of importing large amounts of cheap frozen meat in order to hold down meat prices in the major retail markets had the effect of diverting part of the traditional supply of slaughter animals, particularly from Upper Volta, to more profitable markets elsewhere.²

Imports of Sheep and Goats.-- Table 5 presents officially recorded imports of sheep and goats from 1965 through 1976. In general, the pattern of small ruminant imports was the same as that for cattle. Recorded imports more than doubled between 1965 and 1970, declined slightly

¹Because the port of Lagos was blocked throughout 1976, Nigeria was not able to adopt the Ivorian expedient of importing large quantities of frozen meat by sea in order to hold down retail meat prices. As a result, prices for cattle in Lagos reportedly rose to approximately 300 CFA F per kg. liveweight near the end of 1976, compared to roughly 210 CFA F per kg. liveweight in Abidjan (10).

²Many Voltaic cattle merchants complained to the investigator that the Abidjan market had been "ruined" by frozen meat imports.

TABLE 5
OFFICIALLY RECORDED IMPORTS OF SHEEP AND GOATS INTO IVORY COAST: 1965-76

Year	Mali		Mauritania		Upper Volta		Niger		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent ^a
1965	39,902	28.1	4,936	3.5	86,347	60.8	10,780	7.6	141,965	100.0
1966	18,875	10.4	107,072	59.1	55,311	30.5	—	—	181,258	100.0
1967	—	—	—	—	—	—	—	—	180,517	100.0
1968	27,605	12.3	15,568	6.9	182,015	80.8	—	—	225,188	100.0
1969	89,503	32.0	29,928	10.7	159,929 ^b	57.4 ^b	b	b	279,360	100.0
1970	122,673	39.6	36,135	11.7	128,490	41.5	22,104	7.1	309,402	100.0
1971	—	—	—	—	—	—	—	—	303,479	100.0
1972	—	—	—	—	—	—	—	—	394,044 ^c	100.0
1973	147,295	34.5	23,991	5.6	241,137	56.5	14,636	3.4	427,059	100.0
1974	165,710	42.9	29,919	7.8	187,804	48.7	2,397	0.6	385,830	100.0
1975	96,005	27.2	2,811	0.8	253,517	71.9	309	0.1	352,642	100.0
1976	130,744	43.5	—	—	167,264	55.7	2,263	0.8	300,305	100.0

SOURCES: République de Côte-d'Ivoire, Ministère de la Production Animale, unpublished data; République de Côte-d'Ivoire, Ministère de l'Economie et des Finances, Direction de la Statistique, Situation économique de la Côte-d'Ivoire, various issues and SEDES, Recueil statistique de la production animale, study done for République Française, Ministère de la Coopération (Paris: 1975), p. 45.

NOTES:

-- Not available

— None or negligible

The Ivorian Ministry of Animal Production accepts the figures published in the Recueil statistique de la production animale as the official figures for the years prior to 1972. These figures differ in some years from the figures reported by the Veterinary Service and published in Situation économique de la Côte-d'Ivoire. In years where there are large differences between the Veterinary Service's statistics and the SEDES figures, the latter are used. Figures for the years 1973-76 are from unpublished data of the Ministry of Animal Production.

^a Totals may differ slightly from sum of subtotals due to rounding.

^b Figures for Niger included in the figures for Upper Volta.

^c Recently revised figure, differs from figure previously published by Ministry of Animal Production.

from 1970 to 1971, increased sharply in 1972 and 1973, and then declined markedly from 1973 through 1976.¹ It appears that the same forces that affected cattle imports influenced sheep and goat imports. Rapidly rising incomes in the period 1965-1970 stimulated demand for meat, and imports grew. The effects of the drought started to be felt in 1971, resulting in a slight reduction of imports in that year, followed by a massive destocking of herds in 1972 and 1973. This destocking boosted imports into Ivory Coast during these two years, but was followed by a decline in recorded imports from 1973 through 1976, as the number of animals available for sale from the Sahelian countries dropped as a result of the destocking. Recorded imports of sheep and goats fell proportionately less than did recorded cattle imports, however, declining by roughly 30 percent from 1973 to 1976, compared with a 50 percent drop in recorded cattle imports during the same period. In 1976, recorded sheep and goat imports stood at the same level as in 1970, whereas recorded cattle imports were considerably below their 1970 levels. Sheep and goat imports suffered less direct competition from frozen meat imports than did cattle imports, as the bulk of the frozen meat imported was beef, and practically no frozen mutton or goat meat was sold on the traditional African market.²

Tonnage of Meat Imported on the Hoof.-- The destocking of cattle herds in the Sahelian countries during the period 1972-76 resulted in a change in the composition by sex of cattle herds imported for slaughter

¹The official Ivorian statistics on imports of small ruminants, at least from Upper Volta, appear less accurate than those for cattle, however. For four of the five years for which comparable data are available (1970 and 1973-76), Ivorian import statistics show an average of 20 percent fewer Voltaic small ruminants arriving in Ivory Coast than the Voltaic figures indicate left that country for Ivory Coast. The Voltaic figures, however, show the same pattern of fluctuations as the Ivorian statistics.

²Sales of sheep and goats may have been affected indirectly if consumers shifted from mutton to beef consumption as relatively inexpensive frozen beef became available. This probably did not happen very much. Many of the sheep sold in Ivory Coast are slaughtered for ceremonial occasions. In these circumstances, consumers do not consider beef an acceptable substitute for mutton.

in Ivory Coast. As the drought reduced herd sizes in the north, cattle owners were forced to sell even females and young males to meet their cash needs. As a result, the average carcass weight of cattle slaughtered in Abidjan fell from 151 kg in 1970 to 138 kg in 1976.¹ The carcass weights of small ruminants may also have fallen during this period, but data are unavailable to confirm this. Therefore, in the following calculations, a constant carcass weight of 17 kg is assumed for small ruminants. (This weight is taken from 23, p. 117.)

Table 6 presents the estimated tonnage of beef and small ruminant meat imported into Ivory Coast from 1970 through 1976, based on the data presented in Tables 4 and 5 and the average carcass weights mentioned above. Table 6 shows that the total tonnage of beef imported on the hoof fell by nearly half between 1970 and 1976, from 37,448 tons to 20,076 tons. A small part of this decline was offset by an increase in domestic production resulting from Fulani cattlemen moving their herds south into Ivory Coast to escape the drought, but most of it was not met by a corresponding increase in other fresh beef supplies. The result was a decreasing total and per capita fresh beef supply throughout this period. Table 6 also shows that the tonnage of meat represented by recorded small ruminant imports rose from roughly 6,000 tons in 1970 to 8,300 tons in 1973, then fell to less than 6,000 tons in 1976. The Ivorian Planning Ministry (12, Table 10) estimates that imports were somewhat higher than indicated in Table 6, roughly 6,800 tons in 1970 and 8,000 tons in 1975. Examination of Voltaic export statistics (see p. 156, footnote 1) supports the view that the official Ivorian statistics underestimate the number of small ruminants imported. The tonnage of mutton and goat meat imported on the hoof in 1976 was probably closer to 7,000 tons than the 5,900 tons indicated in Table 6.

Imports of Chilled and Frozen Meat

In addition to domestic production and imports of live animals, imports of chilled and frozen meat are the other main source of meat supply

¹See 27, pp. 35-38 for details of how these average carcass weights were estimated.

TABLE 6

ESTIMATED TONNAGE OF BEEF, MUTTON, AND GOAT MEAT
IMPORTED INTO IVORY COAST ON THE HOOF: 1970-76

BEEF					
Year	Number of Animals Imported	Average Carcass Weight (kg.)	Meat (Tons)	Edible Offals (tons) ^a	Total (tons)
1970	198,400	151	29,958	7,490	37,448
1971	175,896	149	26,209	6,522	32,761
1972	212,478	142	30,172	7,543	37,715
1973	223,935	139	31,127	7,782	38,909
1974	193,629	140	27,108	6,777	33,885
1975	140,970	138	19,454	4,863	24,317
1976	112,314	143	16,061	4,015	20,076

MUTTON AND GOAT MEAT					
1970	309,402	17	5,260	789	6,049
1971	303,479	17	5,164	744	5,908
1972	394,044	17	6,699	1,005	7,704
1973	27,059	17	7,260	1,089	8,349
1974	385,830	17	6,559	984	7,543
1975	352,642	17	5,995	899	6,894
1976	300,305	17	5,105	766	5,871

SOURCES; Tables 4 and 5. Average slaughter weights for cattle from Staatz, John M., The Economics of Cattle and Meat Marketing in Ivory Coast (Ann Arbor: Center for Research on Economic Development, 1979), pp. 35-8. Average slaughter weights for small ruminants from SEDES, Approvisionnement en viandes de l'Afrique centre ouest, Secretariat d'Etat aux Affaires Etrangères (France) and Conseil de l'Entente (Paris: 1969), p. 117.

^aEstimated at 25 percent of carcass weight for cattle and 15 percent of carcass weight for small ruminants.

for Ivory Coast. Until 1975, these imports represented a modest volume and were destined almost exclusively for a high-income, largely expatriate clientele in Abidjan. In 1975, however, the pattern completely changed, with large amounts of imported frozen meat (mainly beef) being sold on the traditional African market. Table 7 shows how the volume and sources of supply of Ivory Coast's imports of chilled and frozen meat changed from 1960 through 1976.¹

From 1960 to 1970 recorded imports of chilled and frozen red meat increased from about 500 tons to 2,000 tons per year. Between 60 and 75 percent of this meat was beef, depending on the year, and the bulk of it came from Upper Volta. Recorded imports of chilled and frozen meat declined from 1970 through 1974, reflecting the ending of chilled meat shipments from Mali, Ivory Coast's increasing self-sufficiency in pork production, and a decline in the quality of refrigerated rail transport between Upper Volta and Abidjan.

The decline in chilled frozen meat imports continued through the first half of 1975. The abrupt drop in live animal imports in 1975 reduced the total meat supply on the market, and, in order to check the resulting price rise, the Ivorian government began importing surplus frozen meat from Europe. In one year, recorded imports jumped from 1,473 tons to 6,329 tons. In 1976, recorded imports increased even more rapidly, reaching 17,030 tons, much of it from South America. Almost all this new frozen meat was beef; as a result, beef accounted for over 97 percent of the imports in 1976, compared with 81 percent in the 1971-74 period.

In contrast to previous years, the bulk of the chilled and frozen meat imported in 1975 and 1976 was destined for the traditional African market, not a high-income clientele. This meat was sold on the traditional market (with bones) for between 50 to 100 CFA F less per kg than locally slaughtered meat, which sold in 1976 in Abidjan for 350 to 400 CFA F per kg.

¹For a breakdown of imports by type of meat, see 27, p. 36.

TABLE 7
RECORDED IMPORTS OF CHILLED AND FROZEN RED MEAT BY COUNTRY OF ORIGIN: 1960-76 (tons)

Year	Mali		Upper Volta		Niger		Other African Countries		Total African Countries		Europe		South America		Total ^a	
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
1960	77	14.6	260	49.2	42	8.0	—	—	379	71.8	149	28.2	—	—	528	100.0
1961	—	—	471	54.0	179	20.5	—	—	650	74.5	223	25.5	—	—	873	100.0
1962	—	—	782	70.1	186	16.7	—	—	968	86.8	147	13.2	—	—	1,115	100.0
1963	95	6.4	910	60.9	270	18.1	—	—	1,275	85.3	219	14.7	—	—	1,494	100.0
1964	181	11.3	979	61.0	220	13.7	—	—	1,380	86.0	225	14.0	—	—	1,605	100.0
1965	167	10.7	960	61.3	236	15.1	—	—	1,363	87.0	203	13.0	—	—	1,567	100.0
1966	309	16.2	935	48.9	473	24.8	—	—	1,717	90.9	194	10.1	—	—	1,911	100.0
1967	57	3.0	1,317	68.5	363	18.9	—	—	1,737	90.3	188	9.7	—	—	1,924	100.0
1968	95	4.8	1,304	65.9	418	21.1	—	—	1,817	91.9	160	8.1	—	—	1,978	100.0
1969	179	9.0	1,232	61.7	406	20.3	—	—	1,817	90.9	181	9.1	—	—	1,998	100.0
1970	153	7.6	1,176	58.8	487	24.3	—	—	1,816	90.7	186	9.3	—	—	2,001	100.0
1971	—	—	1,326	72.1	340	18.5	—	—	1,666	90.6	173	9.4	—	—	1,839	100.0
1972	—	—	1,065	71.3	234	15.7	—	—	1,299	87.0	194	13.0	—	—	1,494	100.0
1973	—	—	915	70.7	194	15.0	—	—	1,109	85.7	185	14.3	—	—	1,294	100.0
1974	—	—	1,078	73.2	187	12.7	8	0.5	1,273	86.4	199	13.5	—	—	1,473	100.0
1975	—	—	591	9.3	277	4.4	891	14.1	1,759	27.8	3,990	63.0	580	9.2	6,329	100.0
1976	—	—	247	1.5	162	1.0	896	5.3	1,305	7.7	2,669	15.7	13,056	76.7	17,030	100.0

SOURCE: République de Côte-d'Ivoire, Ministère de la Production Animale, unpublished data.

^aTotals may differ slightly from sum of subtotals due to rounding.

The large imports of frozen meat were initially a reaction to and not the cause of the decline in live animal imports in 1975. Imports of live animals fell sharply in mid-1975 and it was not until September that the massive frozen meat imports began. Once started, however, the sales of cheap frozen meat had the effect of checking the price increase of fresh meat and, as mentioned above, may have served to reduce live animal imports, particularly from Upper Volta.

Not only did the quantities of frozen and chilled meat imported increase tremendously between 1974 and 1976; the pattern of supply completely changed, as well. Up until 1975, the Sahelian countries usually accounted for between 85 and 90 percent of Ivory Coast's recorded frozen and chilled meat imports, with Europe (mainly France) making up the rest. In 1975, however, large imports arrived from Europe, non-Sahelian Africa, and, for the first time, South America. In one year, the combined market share of Mali, Upper Volta, and Niger fell from 85.9 percent to 13.7 percent, and by 1976 it represented only 2.5 percent of total recorded meat imports.

Non-African suppliers entered the Ivorian meat market in 1975 for two reasons. Meat prices in Ivory Coast rose sharply in 1975 because of the shortage of local slaughter animals, thus making Ivory Coast a more attractive market to overseas meat suppliers. More importantly, the world's traditional meat-exporting countries, especially Argentina, were faced with increased stocks of meat in 1975 and fewer markets in which to sell. These countries had expanded their beef production in the early 1970s in response to rising consumer incomes in most developed countries. With the economic slowdown and rise in grain prices in 1973, however, most meat importing countries imposed import restrictions on beef in order to protect domestic producers. This left the meat-exporting countries with large stocks of unsold meat, forcing them to seek out new markets, including West Africa. Ivory Coast was thus able to find very inexpensive frozen beef on the world market just at the time when its traditional beef suppliers, the Sahelian countries, were unable to meet its demand for beef. World meat prices began to rise in late 1976, however, and it is unlikely that in the next five to ten years Ivory Coast

will be able to rely on the world market to the degree it did in 1976 without incurring a large outflow of foreign exchange.

The Ivorian Red Meat Supply: A Summary

Table 8 summarizes the statistics on the Ivorian red meat supply in 1976; it shows that beef is by far the most widely consumed red meat in Ivory Coast, accounting for nearly three-fourths of the total supply. In 1976, meat from small ruminants made up 18 percent of the total, and pork accounted for 9 percent. The bulk of the meat supply is imported. Domestic production accounted for only 26 percent of total red meat consumption in 1976, while imports of live animals from the Sahelian countries supplied about 45 percent; imports of frozen and chilled meat accounted for the remaining 29 percent.

Table 9 presents changes in the Ivorian beef supply in recent years. The table shows that while the total quantity of beef consumed was the same in 1970 and 1976 (approximately 43,600 tons), the pattern of supply changed considerably between these two years. The share of the total supply met by domestic production increased gradually from 11 percent to 16 percent over the period. The major change, however, was the large increase in the relative share of frozen and chilled meat imports. From supplying an average of 3 percent of the total beef supply during the period 1970-74, chilled and frozen beef imports increased to 16 percent of the total supply in 1975 and 38 percent in 1976. The proportion of the total supply met by live animal imports from the Sahelian countries fell from 84 percent in the 1970-74 period to 66 percent in 1975 and 46 percent in 1976.

The massive increase in frozen meat imports in 1975 and 1976 represented the opening of the Ivorian market to non-West African suppliers. Until 1975, 99.7 percent of the Ivorian beef supply was met by domestic production and imports of livestock and meat from neighboring Sahelian countries. By 1976, however, 37.6 percent of the total supply came from outside the West African region: 29.4 percent from South America, 6.2

TABLE 8

ESTIMATED IVORIAN RED MEAT SUPPLY IN 1976
(tons of meat and edible offals)

Type of Meat	Domestic Production		Imports: Live Animals		Imports: Meat		Total	
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
Beef	6,923	11.6	20,076	33.6	16,611	27.8	43,610	73.0
Mutton/Goat Meat	3,600 ^a	6.0	7,000 ^b	11.7	339	0.6	10,939	18.3
Pork	5,150 ^a	8.6	--	--	47	0.1	5,197	8.7
Horse	--	--	--	--	33	--	33	--
Total	15,673	26.2	27,076	45.3	17,030	28.5	59,779	100.0

SOURCES: Tables 3, 6, 7 and text.

^a Domestic goat, mutton, and pork production estimated at three percent above their 1975 levels.^b Author's estimate based on examination of statistics from exporting countries (see p.157).

TABLE 9
THE IVORIAN BEEF SUPPLY: 1970-76 (TONS OF MEAT AND EDIBLE OFFALS)

Year	Imports				Domestic Production		Total ^a	
	Live Animals		Fresh, Chilled, and Frozen Meat		Total Imports		Tons	Percent
	Tons	Percent	Tons	Percent	Tons	Percent		
1970	37,448	85.8	1,477	3.4	38,925	89.2	4,700	10.8
1971	32,761	83.1	1,405	3.6	34,166	86.7	5,243	13.3
1972	37,715	84.9	1,205	2.7	38,920	87.6	5,507	12.4
1973	38,909	85.0	1,077	2.3	39,986	87.3	5,796	12.7
1974	33,885	81.7	1,243	3.0	35,128	84.7	6,349	15.3
1975	24,317	65.5	6,093	16.4	30,410	82.0	6,689	18.0
1976	20,076	46.0	16,611	38.1	36,687	84.1	6,923	15.9
							43,625	100.0
							39,409	100.0
							44,426	100.0
							45,782	100.0
							41,477	100.0
							37,100	100.0
							43,610	100.0

SOURCES: Tables 2, 6, and 7.

^aTotals may differ slightly from sum of subtotals due to rounding.

percent from Europe, and 2.0 percent from Southern and East Africa. The total recorded amount of non-West African meat imported in 1976 equaled 16,424 tons. This was the equivalent of roughly 91,880 head of Sahelian cattle.¹

The Ivorian market for cattle and beef thus changed radically between 1974 and 1976. Meat imports from Latin America and Europe began to play an important role in supplying Ivory Coast with meat, and the Sahelian states faced the spectre of having to compete with non-West African meat exporters for a share of the Ivorian market. Ivory Coast itself was trying to increase domestic livestock production during this period in order to reduce the country's reliance on livestock and meat imports from all sources. Within the context of this changing supply pattern, the question of the efficiency of the traditional cattle and meat marketing system became especially important. Was inefficiency in the traditional marketing system partly to blame for the Sahelian countries' declining share of the Ivorian market? Did exploitative livestock traders offer extremely low prices to Ivorian cattle producers, thus discouraging domestic production? Could the traditional marketing system adapt to the new supply conditions, or were new marketing structures needed? The micro-economic-level research described in the following sections of this paper was aimed at answering these questions.

MARKET ORGANIZATION: A CONSTRAINT TO DEVELOPMENT?

Many government officials and foreign advisors in West Africa believe that the traditional organization of cattle and meat marketing prevents efficient market operation. Three problems are alleged to exist: 1) that a large number of the market participants, particularly intermediaries, provides no useful services to buyers or sellers and are unnecessary "parasites" on the system; 2) that traders and intermediaries sometimes conspire to restrict the number of animals sold, thus artificially raising

¹Based on an average carcass weight of 143 kg plus edible offals equal to 25 percent of carcass weight. (See Table 6.)

prices; 3) that many market participants, particularly butchers, lack the basic business skills needed for expansion of the trade. Most West African governments have called for reorganization of the cattle trade in recent years. For example, the Entente states (Ivory Coast, Togo, Benin, Niger, and Upper Volta) have signed agreements (5) aimed at guaranteeing more state control over the trade. Ghana has gone even further, replacing the traditional marketing system with a state monopoly.

This study examined the need for market reorganization by looking at the structure, conduct, and performance of the current marketing system. Market structure was evaluated by measuring the degree of buyer and seller concentration in the Abidjan and Bouaké markets. Market conduct was examined by studying the roles played by different agents in the marketing system and by examining the incidence of collusion. Market performance was judged by examining the net margins of butchers and traders. The research showed that the traditional marketing system is fairly competitive. Market concentration among both buyers and sellers is, in most instances, low enough to make collusive agreements inherently unstable. Collusion among intermediaries to restrict the number of animals sold appears rare, although intermediaries sometimes do collude in deciding to whom they will sell. The research also showed that most intermediaries provide important services to buyers and sellers, including guaranteeing credit, facilitating sales, and speeding the flow of market information. The research also showed that the net margins of butchers and cattle traders are modest, together accounting for about 14 percent of the retail price of beef in Abidjan and Bouaké.

Market Structure

Economic theory suggests that a high degree of market concentration is often associated with non-competitive pricing arrangements. While a high degree of market concentration does not prove the existence of collusive pricing in a market, there are strong theoretical reasons to believe that the presence of few sellers in a market, each having a large

market share, is often associated with non-competitive pricing.¹ In West Africa, it is often alleged that a few large cattle merchants and intermediaries control such a high proportion of sales in certain markets that they can restrict the number of animals sold, thereby forcing up prices and earning monopoly profits.

Data collected during the field studies in Bouaké and Abidjan can be used to measure the degree of market concentration among major intermediaries in these two cities and to draw inferences about the likely degree of competition among them. Concentration ratios, which measure the proportion of total sales handled by a given person, were calculated for intermediaries in both Abidjan and Bouaké, based on several month's data.² Table 10 summarizes the results.

Table 10 indicates that in Abidjan a large number of sellers were present and market shares were typically small. Even in the month of highest seller concentration, the four largest intermediaries in Abidjan controlled only 36 percent of total sales and the largest eight controlled only 56 percent. Most authors agree that with such a low degree of market concentration it would be extremely difficult to maintain collusive agreements aimed at restricting sales (2, pp. 112-24). In Bouaké, there were fewer total sellers in the market, and market shares were larger. During the month of highest concentration, the four largest intermediaries controlled nearly 70 percent of total sales. During most months, however, the market share of the four largest intermediaries was between 50 and 60 percent. Although market concentration was higher in Bouaké than in Abidjan, in most months it was still low enough to make collusive agreements inherently unstable. Furthermore, most intermediaries received the largest part of their income from a fixed commission which was paid to them (by the purchaser) for every animal they sold. Since the commission did not vary with the price of the animal, intermediaries usually had an interest in maximizing, not restricting, the number of cattle sold.

¹These theoretical arguments are discussed in 27, pp. 124-26.

²See 27, pp. 128-31 for details of how these concentration ratios were calculated.

TABLE 10
CONCENTRATION RATIOS FOR LARGE AND MEDIUM-SCALE
INTERMEDIARIES IN ABIDJAN AND BOUAKÉ^a

Number of Sellers	Percentage of Total Sales	
	Abidjan	Bouaké
Entire Period of Observation (Dec., 1976-June, 1977) (Sept., 1976-June, 1977)		
Largest 1	6.8	20.1
Largest 4	23.2	45.3
Largest 8	37.1	63.5
Largest 20	64.4	87.8
Total Number of Sellers	140	62
Month of Highest Concentration ^b (February, 1977) (January, 1977)		
Largest 1	12.4	23.6
Largest 4	35.7	69.0
Largest 8	55.6	86.7
Largest 20	76.4	--
Total Number of Sellers	62	17
Month of Lowest Concentration (May, 1977) (November, 1976)		
Largest 1	7.6	12.4
Largest 4	26.6	43.6
Largest 8	44.4	64.5
Largest 20	77.0	83.3
Total Number of Sellers	61	24

^a Includes intermediaries and merchants who sold without the aid of an intermediary.

^b Degree of concentration measured by the percentage of total sales handled by the four largest intermediaries.

Therefore, even in the months of highest seller concentration in Bouaké, when it would have been easiest for intermediaries to collude to restrict sales, it is not clear that it would have been in their interest to do so.

Concentration among butchers in Abidjan appeared to be at roughly the same level as that among intermediaries in Abidjan, although the data necessary to calculate concentration ratios for most butchers were unavailable. About fifty-five butchers bought and slaughtered cattle in Abidjan in early 1977, and the market share of the largest butcher was approximately 15 percent. In Bouaké, market concentration among butchers was very low. Approximately forty-five butchers were active in the Bouaké cattle market in 1976-77; no butcher slaughtered more than two head of cattle per day, and most slaughtered only one. On the buyers' side, the Bouaké cattle market therefore approached the perfectly competitive model of many buyers, each with equally small market shares.

In summary, the data on market structure suggest that the scope for collusive behavior by buyers and sellers of cattle in Abidjan and Bouaké was quite limited. The degree to which sellers could artificially raise prices was further limited by the availability to butchers of inexpensive frozen beef. If butchers found cattle prices too high, they could sell frozen meat instead of slaughtering cattle.

Market Conduct

Market conduct was examined by studying the roles played by different agents in the marketing system and by noting the incidence of collusion. A detailed description of the roles of different marketing agents is presented elsewhere (27, Chapters 3 and 4). The discussion below concentrates on the role of intermediaries, the market agents most frequently criticized as being "parasites" on the marketing system, and on the organization of the indigenous training systems for butchers and traders. The discussion also deals with the types and incidence of collusion observed in Bouaké and Abidjan.

The research showed that the term "intermediary" covers a wide variety of marketing agents, ranging from large-scale cattle brokers to small-scale traders. In its broadest sense, the word refers to anyone who comes between a northern cattle merchant and a southern butcher. In a narrower sense, however, the word refers only to cattle brokers, who arrange to sell a cattle merchant's animals, but do not actually buy the animals themselves. Most intermediaries (especially large-scale intermediaries) play important roles in helping northern cattle merchants sell their animals in unfamiliar markets, transmitting market information, and guaranteeing the credit of local buyers. Roughly 25 percent of all cattle sales in Bouaké and 50 percent of all sales in Abidjan are on credit, and the bulk of this credit is guaranteed by intermediaries. If authorities tried to eliminate intermediaries from the marketing system (as is sometimes advocated) without creating an organization to replace the intermediaries' credit function, a severe credit constraint would arise in the Bouaké and Abidjan cattle markets. A reduction in the availability of credit of this sort would greatly increase the working capital required to buy and slaughter cattle. This, in turn, would make it more difficult to enter the butchering trade and would probably force some butchers out of business, thus reducing competition in the trade and probably leading to higher meat prices.

Many butchers, however, complain about the large number of small-scale intermediaries in the Abidjan and Bouaké markets. Small-scale intermediaries handle only a few animals at a time and typically do not extend or guarantee credit. Usually they restrict their activities to buying animals on credit from large-scale intermediaries and reselling the animals to butchers for a profit. Interview with butchers and traders in Abidjan and Bouaké indicated that the number of small-scale intermediaries in these markets increased substantially following the Sahelian drought of the late 1960s and early 1970s. The research showed that in the short run, the activities of these small-scale intermediaries may indeed raise the price of cattle. Their activities also have the effect, however, of speeding up the sale of cattle in the south, thereby increasing the rate of capital rotation of northern merchants.

This, in turn, raises the profitability of the north-south cattle trade (See 27, pp. 138-40). The higher profitability encourages more merchants to ship animals south and may, in the long run, lead to lower prices. Thus, even where the charge of intermediaries being "parasites" seems strongest, it is far from proven.

Cattle and meat marketing require specialized knowledge, and the traditional marketing system has developed indigenous training programs to impart this knowledge to people entering the trade. Most cattle merchants, large-scale intermediaries, and butchers spend several years as assistants or apprentices before entering the trade themselves. For example, butchers interviewed in Bouaké spent an average of 7.5 years as apprentices before becoming independent butchers. During their apprenticeships, young butchers and cattle merchants learn the fundamentals of cattle and meat marketing and accumulate the capital needed to enter the trade. There is, therefore, little evidence that merchants and butchers need special government training programs to teach them business fundamentals. Most cattle traders and butchers are highly experienced individuals having a detailed knowledge of their profession.

In over a year's observation of the Bouaké and Abidjan cattle markets, the investigator never observed collusion among intermediaries to restrict the number of cattle sold in order to force up prices, nor among butchers to restrict the volume of meat sold. Butchers, in fact, often complained about their inability to form a collusive bloc to deal with the intermediaries. Intermediaries, for their part, usually received the majority of their income from a fixed commission on every animal sold, and therefore has an interest in maximizing, not restricting, the number of animals sold.

Intermediaries would sometimes collude in deciding to whom they would sell, but not on the volume of sales. Intermediaries sometimes refused to sell to buyers who had defaulted on previous purchases on credit, in order to try to force repayment of the debt. Butchers also claimed that large-scale intermediaries would sometimes refuse to deal directly with butchers, preferring to pass through smaller scale intermediaries, who were often related to the large intermediaries. This occasional refusal

by some large-scale intermediaries to deal directly with butchers led to many of the charges of "parasitism" that were discussed above.

Market Performance

Market performance was examined by looking at butchers' and traders' net margins, the net returns to these agents' capital and labor. Although the gross margin¹ of merchants who ship cattle to Ivory Coast from Mali and Upper Volta is typically large, most of this gross margin is attributable to transport costs and export taxes, not profits. The merchants' profits typically account for between 4 and 9 percent of the final sale price of cattle shipped to Abidjan and Bouaké. Rates of return to capital of traders who shipped cattle to Bouaké in 1976-77 varied between 16 and 30 percent per year, within the range of the accepted opportunity cost of capital in West Africa. Rates of return to capital of merchants who shipped cattle to Abidjan in 1976-77 were higher, but the high returns were apparently due to a transportation bottleneck that restricted cattle shipments to Abidjan and to the high risk of shipping cattle to Abidjan (due to the volatility of Abidjan cattle prices), not to collusion on the part of cattle merchants.

Similarly, the net margins of class 2 (traditional) butchers in Bouaké and Abidjan were fairly low, accounting for between 8 and 12 percent of the retail price of beef. These margins were considerably below those earned by class 1 (European-style) butchers in Ivory Coast.

Table 11 shows how much of the retail price of beef in Abidjan in 1977 was attributable to different costs. The figures are based on a 150-kg carcass weight animal purchased in Ouagadougou and shipped to Abidjan by rail.² Table 11 indicates that although the gross marketing

¹The gross margin is the difference between the producer price and the retail price.

²See 27, pp. 428-30, for details of how the figures in Table 11 were calculated. During 1976-77 Ouagadougou was the single most important source of cattle sold in Abidjan, accounting for about 44 percent of the total.

TABLE 11
EVOLUTION OF THE COST OF BEEF AND OFFALS SOLD RETAIL IN ABIDJAN

Item	Percent of Final Sale Price
1. Purchase of animal in Ouagadougou	46.8
2. Labor	
Shipping Cattle	0.5
Slaughter	0.6
Total Labor	1.1
3. Intermediaries' commissions & margins	1.9
4. Taxes and licenses	
Ivory Coast	4.3
Upper Volta	8.4
Total Taxes	12.7
5. Transport of cattle	
Transport fees	6.1
Shrinkage	7.0
Losses and forced sales	1.5
Total Transport	14.6
6. Selling costs of meat	
Transport, stall rental, & Labor ^a	4.4
Wastage (bone)	1.0
Losses due to condemnations & default on credit sales	0.8
Total Selling Costs	6.2
7. Profits	
Cattle trader	5.0
Wholesale-retail butcher	7.5
Vendor of fifth quarter	4.1
Total Profits	16.6

^aIncludes an estimated total cost of selling offals (stall rental, labor, transport, and wastage) of 2,500 CFAF per animal.

margin accounted for over half the retail price of beef and offals in Abidjan, only about 19 percent of the retail price was attributable to total profits. Cattle traders' profits accounted for about 5 percent of the retail price of beef in Abidjan, and the profits of wholesale and retail butchers accounted for less than 8 percent. Intermediaries' commissions, which officials often decry as inflationary, accounted for only about 2 percent. Therefore, even if the profits of all butchers, traders, and intermediaries were reduced to zero, the retail price of beef in Abidjan would fall by less than 20 percent. In contrast, transport costs (including the high implicit cost of weight loss en route) accounted for about 15 percent of the retail price of beef, while taxes and licenses accounted for about 13 percent.

In summary, the data on market structure, function, and performance seem to indicate that the traditional cattle and meat marketing system works fairly efficiently. The data lend little support to the assertions that a few intermediaries and traders exercise monopoly power over major markets or that traders profits are exorbitant.

MARKET INFRASTRUCTURE NEEDS¹

Most cattle marketing projects undertaken by the Ivorian government and donor agencies have emphasized improving market infrastructure, e.g., by providing cattle scales to markets and by constructing modern abattoirs. Planners seem to hope that by duplicating the structure of cattle markets in developed countries, the efficiency of those markets can be duplicated. Some officials also seem to hope that by moving to the sale of cattle on a per-kg basis it will be easier for the government to set cattle prices. Most marketing projects have therefore emphasized changing the structure of the marketing system to make it correspond more closely to the market structure in developed countries rather than looking at the functions a

¹This section deals exclusively with the infrastructure needs of cattle markets and abattoirs in Ivory Coast. Needs for improved transportation infrastructure are discussed in the following section.

marketing system must perform, identifying the infrastructure constraints that prevent the current system from performing those tasks efficiently, and moving to relax these constraints.

As a result of the this "structuralist" approach to market reform, the infrastructure provided by several marketing projects has not corresponded to the needs of the marketing system. For example, plans have called for installing cattle scales in major cattle markets and encouraging the sale of cattle on a per-kg basis, even though there is little evidence that a lack of scales has hindered efficient market operation. In fact, cattle and meat prices in Ivory Coast fluctuate seasonally and from day to day in a manner entirely consistent with fluctuations in supply and demand, and the distribution of prices per kg. of cattle sold on sight in Abidjan and Bouaké is tightly clustered about the mean, indicating that butchers accurately estimate carcass weights without using scales.¹ Furthermore, in markets where cattle scales have been installed, butchers and traders have refused to use them.²

There are, however, serious market infrastructure constraints to cattle and meat marketing in Ivory Coast (particularly in Abidjan) that marketing projects have not addressed. These involve inadequate slaughterhouses in Abidjan and Bouaké, the lack of grazing space near the Abidjan market, and poor unloading facilities for cattle. Each is discussed briefly below.

¹For zebu males with carcass weights of between 130 and 160 kg sold in Bouaké during the study period, the standard deviation of average monthly prices per kg was only 8.5 percent of the mean. In other words, 68 percent of all prices fell within ± 8.5 percent of the mean. Furthermore, not all of the variation around the mean was random; some was due to daily fluctuations in supply and demand and to differences in the degree of finish of the animals.

²There are three main reasons why butchers and traders in these markets are reluctant to sell animals by weight. First, it is difficult to weigh cattle that are not used to being handled, and the risk of injury, either to the animals or to the person trying to weigh them, is significant. Second, the scales are often out of adjustment, giving inaccurate weights. Third, differences in gut fill among animals can lead to significant fluctuations in liveweights.

The Abidjan abattoir, originally constructed as modern, assembly-line slaughterhouse, has not been maintained, and currently, conditions of slaughter are extremely poor. Few carcass hoists in the abattoir still function, so animals are gutted on the floor, where they lie surrounded by blood and intestinal contents. Extensive refurbishing of the Abidjan abattoir is needed to insure the basic cleanliness of slaughter facilities in the Ivorian capital. In contrast, the Bouaké abattoir is an extremely simple structure (an open-sided building with cement floors and hand-operated carcass hoists), and conditions during slaughter in Bouaké are much more hygienic than in Abidjan. The Bouaké abattoir, however, was built in 1946 and is now too small to handle adequately the number of animals passing through it. It needs replacing, preferably by a structure designed along the lines of the current abattoir.

A second major infrastructure constraint to cattle marketing in Ivory Coast is a lack of grazing space around the abattoir and cattle market in Abidjan, Ivory Coast's largest market for beef. The lack of grazing prevents butchers and merchants from holding a buffer stock of animals to smooth out supply fluctuations. Since rail shipments of cattle to Abidjan are irregular, the supply of cattle in Abidjan varies widely from day to day. With no buffer stock to absorb some of this variation, prices there are volatile. The instability of cattle prices in Abidjan leads to a higher rate of default on debts by butchers and more fluctuant meat prices than in Bouaké, where cattle can be held as a hedge against supply fluctuations. As a result, Abidjan is a riskier market for northern cattle merchants than is Bouaké.¹

A third problem at the Abidjan cattle market is that inadequate unloading facilities prevent cattle from being unloaded from rail cars at night. As a result, cattle arriving in Abidjan often must wait ten hours or more before they can be unloaded. Most cattle arriving in Abidjan by rail have already spent two to three days en route without food or water. The additional ten-hour wait in Abidjan at the end of the journey,

¹ Similar problems due to a lack of grazing are developing on a smaller scale at the cattle market in Man.

when the animals are very weak from the trip, significantly increases mortality and weight losses of cattle shipped by rail.

Given the difficulties of holding cattle in Abidjan and the poor condition of the Abidjan abattoir, officials should seriously consider moving the cattle market-abattoir complex out of the industrial zone of Port Bouët to an area where adequate grazing and water are available. Unless the market is moved or unless means are found to provide forage economically to the cattle at the present location, many of the current problems of cattle marketing in Abidjan (e.g., the high rate of default on debts) are likely to continue.

Even if the Abidjan abattoir is not moved from its present location, it will eventually become necessary to refurbish or rebuild it. When refurbishing the Abidjan abattoir or building new abattoirs in other cities, officials should keep two principles in mind. First, they should avoid overcapitalizing the slaughterhouses, i.e., replacing inexpensive labor with expensive imported capital equipment. Most modern abattoirs constructed in Africa are designed after abattoirs in developed countries, where capital is relatively cheap and labor is relatively expensive. In developing countries, however, the relative prices of capital and labor are just the reverse. If officials contract for the construction of abattoirs with companies that simply copy the plans of European or North American slaughterhouses rather than try to adapt these plans to African price conditions, the cost of slaughtering probably will be raised substantially above what it otherwise would have been, and many of the laborers currently involved in slaughtering will be thrown out of work.

The second point to be kept in mind is that the equipment used in the abattoirs should be simple and easy to repair. Equipment like power hoists and electric scales are likely to break down often when given heavy use by relatively untrained abattoir personnel. Simple manual equipment for which spare parts can be made locally, is likely to be both cheaper and more reliable than more complicated power equipment.

A "functional" approach to improving market infrastructure may prove more valuable than the "structural" approach used widely up to now. The goal of improved market infrastructure is to help the marketing system

efficiently perform its tasks of distributing cattle and meat. Given the problems facing cattle merchants and butchers in Ivory Coast, the infrastructure needs may not always be the same as those in developed countries. Plans for improving market infrastructure should therefore be preceded by an analysis of the critical constraints to marketing, and the improvements in infrastructure should be designed to relax those constraints.

PROBLEMS AND COSTS OF TRANSPORTING CATTLE

Cattle marketing in West Africa is characterized by long distances between the areas of livestock production in the Sahelian countries and the major meat-consuming regions in the coastal countries. Because of the distances involved, transport costs for livestock become important components of the retail price of meat in the coastal areas. Reducing transport costs for cattle could therefore benefit both producers and consumers of beef considerably. This section examines the costs of alternative means of transporting cattle in West Africa and discusses some of the policy issues involved in livestock transport.

Current Pattern of Cattle Transport

Cattle travel to market in West Africa on hoof, by truck, by train, or by some combination of these methods. Trekking remains the most common means of transport, with almost all animals except those from government feedlots trekking at least part of the way to market. Rail transport is commonly used to ship cattle very long distances (e.g., from Ouagadougou to Abidjan) and to ship cattle shorter distances during the dry season, when grazing along trek routes is sparse. Long-distance trucking of cattle all the way from livestock-producing areas in the north to major consumption markets in the south is used very rarely, but intermediate-distance trucking of cattle within the forest zone of Ivory Coast is fairly common. Many observers feel that the heavy reliance placed on trekking results in

several problems, including high mortality and weight losses during shipment and extensive crop damage to fields along major trek routes. In order to reduce these alleged problems, the Ivorian government has advocated increased use of truck and rail transport for cattle.

Transport Costs

The cost of transporting cattle includes direct cash costs, such as truck rental and wages of drovers; indirect (non-cash) private costs, such as mortality and weight losses during shipment; and social costs, such as the value of damaged crops for which no compensation is paid. This subsection outlines these costs, evaluating the advantages and disadvantages of transporting cattle by trek, truck, and rail.

Trekking.-- Trekking is a relatively inexpensive means of transporting cattle within the Sudanese and Guinea savanna zones. Most cattle merchants prefer trekking to other means of transport because trekking requires a low cash outlay and allows the merchant more flexibility than trucking or rail transport in timing the arrival of his herd to coincide with favorable market conditions. Typically a merchant whose cattle are trekked to market arrives at the market of destination a few days before the scheduled arrival of this herd in order to contact an intermediary and to evaluate market conditions. If prices are high, the merchant sends word to his drovers to rush the cattle to market so that he can benefit from the high prices. If prices are low, he tells the drovers to slow down and wait for market conditions to improve. When shipping cattle by truck or rail, merchants must often wait several days for trucks or train cars to become available, and it is therefore more difficult to time the animals arrival to correspond with favorable market conditions.

The low cash outlay required for trekking is illustrated in Table 12, which compares the cost of trekking cattle to Bouaké from Tingrela, on the Mali - Ivory Coast border, with the cost of trucking them along the same route. Table 12 indicates that for a cash outlay of 86,000 CFA F

TABLE 12

COST OF TRANSPORTING FIFTY HEAD OF CATTLE FROM TINGRELA OR BOUNDIALI TO BOUAKE
BY TREKKING AND BY TRUCK: 1976-77 (in CFAP)

Expense	Trek		Truck	
	Total	Per Animal	Total	Per Animal
1. Salary of drovers	3 @ 10,000 = 30,000	600	2 @ 5,000 = 10,000	200
2. Food for drovers	15,000	300	—	—
3. Return trip for drovers	3 @ 2,500 = 7,500	150	2 @ 2,500 = 5,000	100
4. Round-trip for owner	5,000	100	5,000	100
5. Food for owner in Bouaké 7 days @ 200 CFAP/day	1,400	28	1,400	28
6. Health certificate	2,000	40	2,000	40
7. Vaccination	1,750	35	1,750	35
8. Amortization of cattle merchant's license	12,100	242	12,100	242
9. Indemnity for damaged fields	475	10	—	—
10. Loss of animals	1.0% of 50 animals @ 40,000 CFAP per animal = 20,000	400	1.6% of 50 animals @ 40,000 CFAP per animal = 32,000	640
11. Forced sales	0.6% of 50 animals @ 20,000 CFAP loss per animal = 6,000	120	0.6% of 50 animals @ 20,000 CFAP loss per animal = 6,000	120
12. Truck rental	—	—	2 trucks @ 87,500 CFAP each = 175,000	3,500

TABLE 12 CONTINUED

Expense	Trek		Per Animal		Truck Transport	
	Total				Total	Per Animal -
13. Unofficial costs	—	—	—	—	10,000	200
14. Cattle market tax: Bouaké	10,000		200		10,000	200
15. Gift to landlord	0-5,000		0-100		0-5,000	0-100
Total Cost (excluding weight loss)	111,225 - 116,225	2,225 - 2,325			270,250 - 275,250	5,405 - 5,505
Days in transit from:						
Boundiali			25			1
Tingrela			30			1

(total costs excluding weight losses, losses of animals, and forced sales) a merchant could trek fifty head of cattle from Tingrela to Bouaké and sell them in the Bouaké market. To ship the same animals by truck and sell them in the Bouaké market required a cash outlay nearly three times as large, 233,000 CFA F. Time in transit, however, was only one day by truck compared with 30 days by trek.

The indirect costs of trekking (losses of animals en route, forced sales, weight losses, and crop damage) are typically low in the Sudanese and Guinea savanna zones. Interviews conducted in 1976-77 with the chief drovers of thirty herds trekked to Bouaké indicated that only 1 percent of their animals were lost en route, and that mortality per se among trekked animals was extremely low.¹ Forced sales (sales at a loss of animals that were too ill, too injured, or too exhausted to continue the trip) were likewise extremely low, accounting for 0.6 percent of the animals trekked to Bouaké. (See 27, pp. 218-20 for details.) Weight losses during trekking are extremely variable, depending, among other things, on the season, the state of health of the animals, and the speed at which the cattle are trekked. Data on weight losses are scarce, but those that do exist suggest that weight losses during trekking may not be as high as is sometimes alleged. Weighings of cattle trekked between Sikasso, Mali and Bouaké during the rainy season indicated that herds can actually gain weight when trekked during the rainy season (27, pp. 221-24). Data from Upper Volta (18) show that even during the dry season, cattle do not always lose weight during trekking.

Government officials in Ivory Coast often cite crop damage by trade herds as a major social cost of trekking. Data collected in Bouaké, how-

¹Most animals lost during trekking simply became separated from the herds and were lost in the surrounding countryside. Only mortality losses represented net losses to society. Animals lost in the bush during trekking represent losses to cattle merchants, but not to society as a whole, because someone presumably found the lost animals and either raised them or slaughtered them.

ever, indicate that cost of crop damage per animal trekked to market is extremely low, on the order of 10 CFA F. Even if the incidence of crop damage were several times higher than indicated by these data, it would not be high enough, from an economic standpoint, to justify trucking.¹

The major disadvantage of trekking, from a merchant's point of view, is that it takes longer than trucking or rail shipment; therefore, a merchant cannot rotate his capital as quickly as with other means of transport. Nevertheless, during the study period, trekking cattle to market was generally more profitable than trucking them, even taking into account the slower rate of capital rotation involved.

Trucking.-- Long-distance trucking is often advocated as a solution to the problems of weight loss and crop damage associated with trekking. Data collected during the study (as typified by the figures presented in Table 12), however, indicate that trucking is an expensive way of moving cattle in the Sudanese and Guinea savanna zones. The high cost of trucking explains why few merchants currently truck cattle long distances in Ivory Coast. Trucking is competitive within the forest zone, however, where trekking is difficult (and in some areas forbidden), and trucking within the forest zone is common.

Several factors work against long-distance trucking of cattle in Ivory Coast. Truck rental rates per animal are high because truckers can usually earn more money hauling cargoes with higher weight-to-volume ratio than cattle. Truckers therefore regard cattle as a backhaul cargo of last resort, a cargo that pays only some of the costs of the return trip south.² In 1977 truck rentals fees accounted for 75 percent of cash cost and 65 percent of the total cost (excluding weight losses) of trucking cattle between Tingrela

¹An alternative means of dealing with the problem of crop damage is discussed below in the section on policy recommendations.

²Data on transport costs in Ivory Coast collected by SETEC International (21) indicate that in 1976 it cost roughly 117,000 CFA F to operate an 18-ton truck (capable of hauling 25 head of cattle) between Tingrela and Bouaké. Table 12 shows that this was 29,500 CFA F more than could be earned hauling cattle along this route.

and Bouaké. Other major costs of trucking are the bribes and "gifts" that truckers and merchants are sometimes forced to pay police and customs officials along the route. These costs are less important for trekked herds than for trucked herds because drovers can often avoid police checkpoints by trekking their animals away from the main roads.

The indirect costs of mortality and weight losses during trucking also appear to be substantial. Because of the small number of cattle shipped long distances by truck in Ivory Coast, it proved impossible during the study to empirically determine the mortality rate for trucked cattle. Cattle traders interviewed in Abidjan and Bouaké, however, generally stated that about twice as many animals were lost during trucking as during trekking. Weighings of cattle trucked to Abidjan from Niono, Mali and from Ferkéssédougou, Ivory Coast indicated that net carcass weight losses during trucking were fairly high, about 2.7 percent per day in transit (27, pp. 242-43).

The main advantages of long-distance trucking of cattle are that it allows merchants to react quickly to shortages of cattle in the consumption markets (if they can quickly find trucks to transport their animals) and it permits a more rapid rotation of capital. For example, instead of trekking his animals for thirty days between Tingrela and Bouaké, a merchant can truck them to Bouaké in a single day. Even if it takes him a week to assemble the herd in Tingrela, three days to find a truck, a week to sell the animals in Bouaké, and a day to return to Tingrela, his rate of capital rotation will be two and one-half times that of a merchant who trekked his cattle to market (eighteen days versus forty-five days). During most of the study period, however, the price differential between markets was not high enough to make trucking more profitable than trekking, even taking into account the faster rate of capital rotation. Long-distance trucking was therefore used only when price differentials between markets were unusually high.

The above discussion applies to trucking costs within the Sudanese and Guinea savanna zones. Within the forest zone (i.e., the area south of Bouaké) trekking cattle is difficult because of dense vegetation and heavy tsetse infestation, and in some areas trekking is outlawed. The

real costs of trekking are therefore higher in the forest zone than in the savanna. Trucking costs, on the other hand, are generally lower in the forest zone than in the savanna because most of the main roads within the forest zone are paved. Trucking therefore becomes a viable alternative to trekking in the forest zone, and intermediate-distance trucking of cattle within this zone is common.

Rail Shipment.-- Almost all cattle sold in Abidjan arrive by train. Some trek part of the way to Abidjan before boarding the train (e.g., from Mali to Ferkéssédougou); others, particularly those from Upper Volta, travel the entire distance by rail. Rail shipment is more costly per trip than trekking, but allows cattle to be shipped longer distances, particularly during the dry season, than trekking would allow. Rail transport also permits traders to rotate their capital more quickly than trekking does.

Table 13 shows the typical costs (excluding weight losses) of exporting cattle by rail from Ouagadougou to Abidjan in 1976. The table shows that of the total cost of about 14,000 CFA F per animal, over half was attributable to taxes and license fees. By far the largest of these was the Voltaic export tax of 6,519 CFA F per head. Rail transport charges accounted for about 30 percent of the cost of exporting cattle, and other charges made up the remaining 20 percent. Although rail transport costs are not the single most important cost of exporting cattle from Ouagadougou to Abidjan, they are, nonetheless, a crucial determinant of cattle prices in both cities.

There are three major problems with rail shipment of cattle in Ivory Coast and Upper Volta. First, delays in loading, unloading, and en route result in cattle spending a long time in the poorly ventilated rail cars without food or water. For example, the research showed that on the average cattle shipped from Ouagadougou to Abidjan spend 3.5 days between the time they are loaded in the cars in Ouagadougou and the time they are unloaded in Abidjan. During this time they receive neither food nor water. The results are heavy shrinkage and losses due to mortality. The data indicate that cattle shipped from Ouagadougou to Abidjan lose about 9 percent of their original carcass weights en route. Tissue shrinkage

TABLE 13

COST OF TRANSPORTING FIFTY HEAD OF CATTLE FROM
OUAGADOUGOU TO ABIDJAN BY RAIL (IN CFAF)

Expense	Total Cost	Cost per Animal
1. Marking animals to denote ownership (Ouagadougou)	500	10
2. Landlord's commission in Ouagadougou	12,500	250
3. Payment to herders to watch animals before shipment	7,500	150
4. Export license	4,150	83
5. Veterinary inspection of animals	7,500	150
6. Certificate of origin (100 CFAF per herd)	100	2
7. Salary of drovers 2 @ 5,000 CFAF	10,000	200
8. Food for drovers 2 @ 2,000 CFAF	4,000	80
9. Authorization to export	200	4
10. Voltaic export tax 6,519 CFAF per animal	325,950	6,519
11. Rail transport 2 H12 cars @ 104,666 CFAF	209,332	4,187
Straw for cars	8,000	160
Loading of cars 2 @ 750 CFAF	1,500	30
Unloading of cars 2 @ 500 CFAF	1,000	20
Other charges	0-40,000	0-800
12. Loss of animals 1.6% of 50 animals .8% thrown out for loss of 54,000 CFAF per head	21,600	
.8% sold at an average loss of 27,000 CFAF per load	10,800	
Total loss: mortality	32,400	648
13. Forced Sales 3% of 50 animals at an average loss of 18,000 CFAF per animal	27,000	540
14. Market tax: Abidjan	25,000	500
15. Gift to the landlord	0-5,000	0-100
Total (excluding weight losses)	676,632-721,632	13,533-14,433
Days in transit		2-5

SOURCE: Field study results; Larry Herman, personal communication; and Larry Herman, "Cattle and Meat Marketing in Upper Volta," Report to U.S.A.I.D., (Ann Arbor: 1977), pp. 119-40.

is the single largest cost, excluding export taxes, of shipping cattle between Ouagadougou and Abidjan, costing about 5,700 CFA F per head.¹ Mortality losses and forced sales, while significant, are less important than shrinkage losses, costing about 1,200 CFA F per head. Roughly 1.6 percent of all cattle shipped between Ouagadougou and Abidjan die en route (See Table 14). Mortality losses only become important when cattle spend more than two days in the train cars; therefore, very few cattle shipped by rail within Ivory Coast die en route.

The second major problem of rail shipment is that the cars used by the RAN² to ship cattle are boxcar-style wagons with very poor ventilation. As a result, the cars become very hot inside, and this exacerbates the mortality and weight losses en route.

The third problem of rail transport is a seasonal shortage of rail cars during the peak months of the cattle trade (September to February). The shortage often forces merchants to wait a week or more for cars to ship cattle south. The transportation bottleneck not only reduces the number of cattle that can be shipped to Abidjan; it significantly raises the price of moving cattle south, as merchants incur additional costs as their herds wait at the railroad loading points for cars to become available. These costs are estimated at roughly 124 CFA F per animal per day, or 6,200 CFA F per day for a herd of fifty head (27, pp. 225-26). The costs are passed on to consumers in the form of higher meat prices. The seasonal shortage of rail cars is due to a slow north-south rotation of cars by the RAN. The rotation is slow because merchants who ship goods north in the cars are reluctant to unload them once they arrive in Upper Volta, due to a lack of warehouse space.

¹Viewed another way, the 9 percent carcass weight loss is the equivalent of losing one out of every eleven animals shipped.

²Regie de Chemin de Fer Abidjan-Niger, the railroad linking Ouagadougou and Abidjan.

TABLE 14
ESTIMATED MORTALITY RATES OF CATTLE DURING RAIL SHIPMENT TO ABIDJAN: 1976-77
(PERCENT)

Point of Departure	Distance from Abidjan (km.)	Average Trip ^a Length (days)	Number of Cars in Survey ^b			Estimated Mortality Rate (Percent)			
			H12	H13	J14 Total	H12	H13	J14	Overall
Upper Volta									
Ouagadougou	1,155	3.5	194	26	137	1.3	1.9	1.8	1.6
Koudougou	1,062	3.4	51	1	8	1.3	0	2.5	1.4
Bobo-Dioulasso	806	3.1	133	33	21	0.9	1.5	2.3	1.2
Ivory Coast									
Ouagolodougou	616	1.7	30	1	1	0	0	0	0
Ferkessedougou	560	1.6	158	8	18	0.1	0	0.8	0.1
Tafiré	498	1.6	13	2	0	0	0	0	0
Bouaké	326	1.8	14	1	1	0	0	0	0

^a Results from survey. See 27, pp. 239-41 for details.

^b H12, H13, and J14 refer to different types of cattle cars.

Conclusions

The data collected during the study indicate that cattle merchants currently rely heavily on trekking because trekking is the cheapest way of moving cattle within the savanna zones. Not only are the cash costs of trekking low; the indirect costs, in terms of mortalities and weight loss en route, also appear low during most of the year. Although it involves a slower rate of capital rotation than trucking or rail transport, trekking remains the most profitable way of moving cattle to market in much of Ivory Coast.

Cattle merchants, however, do not rely exclusively on this method of transport. Merchants are quite sensitive to relative transport costs, and have adopted modern means of transport when it has been profitable to do so. For example, virtually all cattle shipped from Upper Volta to Abidjan travel by rail because the distance involved is great (over 1,100 km. between Ouagadougou and Abidjan) and because trekking in the southern half of Ivory Coast is difficult. Similarly, many merchants who export cattle from Mali to Bouaké trek their animals during the rainy season, but shift to a mixture of trekking and rail transport during the dry season, when the risk of mortalities and weight losses during trekking increase. This sensitivity on the part of merchants to relative transport costs suggest that as roads and rail transport improve and cattle prices rise, merchants will increasingly rely on trains and trucks to ship their cattle to market.

FACTORS AFFECTING THE LOCATION OF SLAUGHTER

In recent years, governments of the Sahelian countries and donor agencies have promoted the construction of modern abattoirs in the northern livestock-producing areas, with the goal of shipping refrigerated meat to the coastal areas. The Ivory Coast government has followed a similar policy, contracting for the construction of a refrigerated abattoir in Ferkéssédougou, which will ship meat south to Abidjan. Policy

makers see two advantages in slaughtering in the north and shipping the meat south. First, the shrinkage and mortality losses associated with the shipment of live animals would be reduced or eliminated. Second, slaughtering in the north would increase value added in the north.

To date, however, it has remained more profitable to ship live animals south than to ship chilled meat, and as a result, the chilled meat trade has not developed as planners had hoped that it would. Table 15 illustrates the problem, comparing the profits that could have been earned in early 1977 shipping chilled beef to Abidjan from Ferkéssédougou, where the Ivorian government is constructing a new abattoir, with those that could be earned shipping cattle along the same route.¹ Table 15 shows that given the prices and costs prevailing in early 1977, a merchant could have earned nearly twice as much shipping cattle between Ferkéssédougou and Abidjan as he could have earned slaughtering the animals in Ferkéssédougou and shipping the carcasses south. A similar situation prevailed for shipments of cattle and chilled meat to Abidjan from Bamako and Ouagadougou (27, Chapter 7).

One reason it has remained more profitable to export cattle than meat is the high cost of shipping chilled meat in West Africa. Frequent breakdowns of refrigeration equipment (especially of the poorly maintained refrigerated rail cars used to ship meat between Upper Volta and Abidjan) lead to deterioration of the meat, adding significantly to transport costs.

Transport costs, however, are not the only determinants of the relative profitability of cattle and meat exports. The amount of money that can be earned selling the fifth quarter in the north compared to selling it in the south also plays a crucial role. A model presented in the Appendix

¹In Table 15 and in the subsequent analysis in this section it is assumed that the fifth quarters (i.e., all salable offals) of animals slaughtered in the north are sold in the north and are not shipped south. Typically, without processing, offals tend to spoil quickly. Mittendorf (9, p. 16) reports that even when offals are frozen for shipment south, they lose from 25 to 50 percent of their retail value because of West African consumers' preference for fresh offals.

TABLE 15

COMPARISON OF THE PROFITABILITY OF SHIPPING MEAT
AND CATTLE FROM FERKESSEDOUNGOU TO ABIDJAN (IN CFAF)

Expenses/Receipts	Cost per Animal
Meat Shipment	
Expenses	
Purchase of Animal having 160 kg carcass weight in Ferkessedougou @ 337 CFAF per kg carcass weight	53,920
Slaughter Expenses	
Slaughter tax, veterinary inspection, and cold room fees	2,500
Amortization of butcher's license and union fees	347
Preparation of the carcass for shipment	
2 CFAF per kg	320
Loss through seizures (0.5 percent)	282
Sale of fifth quarter in Ferkessedougou	-5,000
Total Slaughter Cost Minus Value of Offals Sold in Ferkessedougou	-1,551
Refrigerated Rail Shipment:	
23,155 CFAF per ton	3,705
(Refrigerated Truck Shipment:	
30 CFAF per kg)	(4,800)
Unloading of Train Car or Truck: 500 CFAF per car of 8 tons (50 carcasses)	10
Veterinary Inspection Tax in Abidjan:	
10 CFAF per kg	1,600
Total Expenses: Train	57,684
Total Expenses: Truck	58,779
Weight Loss in Transit: 1.5 percent	2.4 kg
Weight of Meat Arrived in Abidjan	157.6 kg
Sale Price per kg in Abidjan	400 CFAF
Gross Receipts	63,040
Profit per Animal	
Rail Transport	5,356
Truck Transport	4,261

See following page for continuation of Table 15

TABLE 15 - CONTINUED

Expenses/Receipts	Cost per Animal
Live Animal Shipment (25 head)	
Expenses	
Purchase of Animal of 160 kg carcass weight in Ferkéssédougou @ 337 CFAF per kg carcass weight	53,920
Salary of Drover	200
5,000 CFAF for 25 head	40
Food for Drover: 1,000 CFAF	--
Return Passage for Drover	160
Round Trip for Owner: 4,000 CFAF	56
Food for Owner in Abidjan: 7 days @ 200 CFAF = 1,400 CFAF	140
Health Certificate: 3,500 CFAF	--
Loss of Animals	--
Forced Sales: 1.5 percent of 25 animals @ 20,000 CFAF loss per animal = 7,500 CFAF	300
Amortization of Cattle Merchants License	242
Rail Transport	2,502
1 H12 car @ 62,558 CFAF	20
Straw: 500 CFAF	40
Loading/Unloading: 1,000 CFAF	40
Other: 1,000 CFAF	500
Abidjan Cattle Market Tax	0-100
Gift to Landlord	58,160 to 58,260
Total Expenses	
Loss of Carcass Weight (2 percent) ¹	3.2 kg
Carcass Weight of Animal in Abidjan	156.8 kg
Sale Price of the Animal per kg Carcassweight in Abidjan	422 CFAF
Gross Receipts	67,738
Profit per Animal	9,458 to 9,558

SOURCE: Staatz, John M., The Economics of Cattle and Meat Marketing in Ivory Coast (Ann Arbor: Center for Research on Economic Development: 1979), pp. 256-57.

shows that under existing conditions, three factors determine whether it is more profitable to export live animals or meat from the north: the price of meat in the south, the price of the fifth quarter in the north, and relative transport costs and shrinkage for cattle and meat. Contrary to a popularly held view, with given transport costs, if the prices of meat and offals in the south rise relative to prices in the north it becomes relatively less, not more, profitable to ship meat than live animals.¹ By slaughtering in the north a merchant forgoes the income he could have earned by selling the fifth quarter in the south, where its price is higher. An increase in meat prices in the south relative to the north will increase the profitability of exporting meat as opposed to live animals only if the price of offals in the south falls relative to the price of meat in the south, a situation unlikely to occur in Abidjan in the next five to ten years. Furthermore, expansion of slaughter in the north in order to increase meat exports would tend to be self-braking. Expanded slaughter in the north would increase the supply of offals in the north, and with no increase in the demand for offals in the north, their price would fall. This would increase the relative profitability of sending the offals south (in the form of a live animal), where their price was higher, rather than slaughtering in the north and selling the offals locally.

The model shows that under conditions likely to prevail during the next five to ten years, the only way in which it could become more profitable to export meat as opposed to live animals would be for the costs of slaughtering in the north and transporting carcasses south to fall relative to the cost of transporting live animals south, or for the price of the fifth quarter in the north to increase relative to the price of meat in the south. Furthermore, if only relative transport costs changed, expansion of slaughter in the north would be self-braking because of a fall in the relative price of offals in the north. Therefore, if export-

¹The absolute profitability of exporting meat increases as the price of meat and offals in the south increases relative to prices in the north, but the relative profitability of meat as opposed to live animal exports falls.

ing meat from the north is to become and remain more profitable than exporting live animals, not only must slaughter costs in the north and the cost of transporting meat fall relative to the cost of transporting live animals, but the price of the fifth quarter in the north must also rise relative to the price of the fifth quarter in the south. One way to increase the demand for the fifth quarter in the north (and hence its price) would be to build processing facilities for offals in the north. Processing would allow northerners to export the fifth quarter to areas where the demand for it is high, rather than being forced to sell it in the north, where the demand for it is limited. This, in turn, would increase the relative profitability of exporting meat as opposed to live animals.

CATTLE AND MEAT PRICES: THEIR IMPLICATIONS FOR NORTHERN FATTENING PROJECTS

The profitability of most livestock development projects ultimately depends in large part on the retail demand for different types of meat. The nature of this demand is reflected in the prices of different types of cattle and of different cuts of meat. This section uses data on cattle and beef prices and information gathered during interviews with meat consumers to draw inferences about the nature of the demand for beef in Ivory Coast and how it is likely to change in the near future.

Types of Markets for Beef in Ivory Coast and Projected Production of Different Grades of Beef

Ivory Coast has two distinct markets for beef: the class 1 market, made up of supermarkets and European-style butcher shops; and the class 2 market, made up of butchers who sell meat in open market stalls. The class 1 market, which caters to the urban elite (expatriates and high-income Africans) handles slightly over 1,800 tons of beef per year, about 4 percent of the total beef consumed in Ivory Coast. Thus, the market for high quality beef in Ivory Coast is small, both in absolute and relative terms.

Projected production of high-quality beef in central West Africa, however, is high. SODEPRA¹ is currently operating a feedlot at Ferkéssé-dougou, and the National Plan projected output from this feedlot would total 16,000 head by 1980, the equivalent of 1,600 tons of fattened rear quarters.² The National Plan calls for a second feedlot to be built in 1980, with a capacity of 20,000 head per year, or 2,000 tons of fattened rear quarters. Mali plans to export 19,000 head of fattened cattle per year to Ivory Coast by 1980 (20), the equivalent of 1,900 tons of fattened rear quarters. Three feedlots have been constructed near Banfora in Upper Volta, with a total capacity of over 6,000 head per year (600 tons of fattened rear quarters) (7). The financial success of almost all these projects depends on the ability of the feedlot operators to sell the fattened animals (or the meat from these animals) at a premium on the Ivorian market. The projected production from these feedlots, however, far exceeds the demand for high-quality beef in Ivory Coast. The production of high quality rear quarters is projected at about 6,000 tons in 1980, while the total demand for high quality beef in Ivory Coast is unlikely to exceed 2,000 tons.

The question arises whether alternative markets can be found for this beef. While some markets may exist in other coastal states (particularly Nigeria), many of these states are setting up their own feedlots. It is therefore likely that the bulk of this high-quality beef, if it is produced, will have to be sold on the class 2 market.

Demand for Fattened Beef in the Class 2 Market

Data on cattle and retail beef prices collected during the study suggest some preference in the class 2 market for fattier, more tender meat. Cattle prices can be used in two ways to draw inferences about the

¹Société pour le Développement des Productions Animales, the Ivorian government agency in charge of promoting domestic livestock production.

²In 1978, however, the feedlot's manager said that production in 1980 would probably total only about 10,000 head (26).

retail demand for tender meat. First, the prices of heavy animals can be compared with those of lighter animals in order to see whether a premium was paid for the larger, generally better-fed animals. Second, the prices of animals of different breeds and sexes can be compared to see if prices are higher for those breeds and sexes reputed to yield fattier meat.

Cattle Prices.-- Data from Bouaké indicate that once the value of the fifth quarter was taken into account, the price per kg carcass weight of zebu males having carcasses 190 kg and heavier was about 1.5 percent higher than the price per kg of males with carcasses of between 130-159 kg.¹ Although such a comparison is hampered by the fact that the weight differences among animals were sometimes due to differences in the frames of the animals, not their degree of finish, it does suggest that class 2 butchers in Bouaké paid a slight premium for fattier, more tender meat.

The preference of consumers, and hence butchers, for fattier meat can be seen more clearly by comparing the prices paid for different breeds and sexes of cattle. Both class 1 and class 2 butchers in Abidjan and Bouaké reported that zebras usually yielded fattier meat than did taurins, and that consumers preferred this fattier meat. Similarly, butchers reported that steers usually yielded fattier meat than either bulls or cows. Table 16 presents average monthly prices in Bouaké of zebu males, zebu-taurin crossbreeds, and taurins during the study period. The table shows that in ten of the thirteen months under consideration the price per kg carcass weight of zebras was above that of taurins and that in nine of the thirteen months the price of zebras was above that of zebu-taurin crossbreeds. For the period as a whole, the price per kg carcass weight of zebu males averaged 369 CFA F, compared with 363 CFA F for zebu-taurin crossbreeds and 351 CFA F for taurins.² The higher price per kg carcass weight of zebras reflected the aforementioned preference of consumers, and

¹See 27, p. 336-37 for details.

²T-tests indicated that differences were statistically significant (27, pp. 332-37).

hence butchers, for the fattier meat from zebu.¹ As would be expected, the price of per kg of zebu-taurin crossbreeds was intermediate between that of zebus and that of taurins.

The prices for taurins and zebu-taurin crossbreeds shown in Table 16 are not broken down by sex or weight of the animal. It is therefore conceivable that the price differences observed in Table 16 resulted from factors other than breed. An economic model of the demand for slaughter cattle in Bouaké was therefore constructed in order to test for significant differences among the prices of different types of cattle (27, pp.343-53). The model allows comparison of average prices by breed and sex, while holding weight and month of sale constant. Table 17 presents the relative prices per kg. of different types of cattle as estimated by the model.

Table 17 confirms that the price per kg carcass weight of zebu was higher than that of other breeds. It also shows that, as expected, the price per kg of steers was higher than the price per kg of either bulls and cows. This pattern of relative prices strongly suggests that consumers in the class 2 market preferred fattier, more tender meat; as mentioned above, zebus generally yielded meat was a higher fat content than did taurins, and steers yielded fattier meat than did either cows or bulls.

Retail Meat Prices.-- Retail meat prices also suggest that consumers who bought beef on the class 2 market preferred some fat in their diet. Beef is sold on the class 2 market both by weight and in small unweighed piles called tas, which are composed of skeletal meat, offals, fat, and bone. When prices of tas are regressed against the weight of meat, bones, offals, and fat in the tas, the coefficients in the resulting equation

¹This preference was reflected in the retail market by the ease with which a butcher could sell his meat. Butchers reported that when they sold meat from taurins they sometimes had trouble selling all their meat during the morning. They were thus required to either put in longer hours at the market to sell all their meat or sell the meat the next day (or in the evening) at a discount.

TABLE 16

AVERAGE MONTHLY CATTLE PRICES IN BOUAKE: JULY 1976-JULY 1977
(CFAF per kg carcass weight)

Month/Year	Zebu Males (130-159 kg. carcass weights)	Zebu-Taurin Crossbreeds ^a	Taurins ^b
1976			
July	344	360	302
(s.d.) ^c	(28)	(28)	
N ^d	23	5	1
August	359	330	335
(s.d.)	(34)	(27)	(27)
N	17	6	6
September	344	321	342
(s.d.)	(37)	(22)	(21)
N	25	2	10
October	343	356	334
(s.d.)	(28)	(58)	(30)
N	32	15	10
November	340	336	329
(s.d.)	(31)	(28)	(34)
N	45	20	4
December	395	383	360
(s.d.)	(45)	(29)	(40)
N	46	33	4
1977			
January	366	364	326
(s.d.)	(29)	(37)	
N	42	40	1
February	382	370	380
(s.d.)	(27)	(32)	(39)
N	58	29	10
March	377	381	324
(s.d.)	(28)	(30)	(28)
N	34	22	2
April	382	389	391
(s.d.)	(33)	(34)	(44)
N	41	32	11

Table 16 continued on next page.

TABLE 16 - CONTINUED

Month/Year	Zebu Males (130-159 kg. carcass weights)	Zebu-Taurin Crossbreeds	Taurins
May	381	376	392
(s.d.)	(25)	(30)	(21)
N	34	28	2
June	406	382	372
(s.d.)	(35)	(31)	(26)
N	21	18	16
July	376	371	382
(s.d.)	(25)	(33)	(27)
N	8	5	4
Average ^e	369	363	351

^eThe average carcass weight of the 255 zebu-taurin crossbreeds in the sample was 144 kg.

^bThe average carcass weight of the 81 taurins in the sample was 126 kg.

^cStandard deviation.

^dNumber of observations.

^eUnweighted average of monthly prices.

TABLE 17
RELATIVE PRICES PER KG. OF DIFFERENT TYPES OF CATTLE
SOLD IN BOUAKE, 1976-77
(percent of price per kg of zebu steers)^a

Breed	Steers	Bulls	Females
Zebus	100.0	96.8	98.9
N'damas	95.9	92.7	94.8
Baoulés	98.3	95.1	97.2
Zebu-Taurin Crossbreeds	99.0	95.8	97.9

^aSee 27, pp.352-53 for details of how these prices were calculated.

represent the implicit prices per kg of each of those constituents. Comparing these implicit prices yields insight into how much consumers value each of these items in their diets.

Analysis of data from Bouaké indicate that for large tas the implicit prices per kg in 1976-77 were the following: skeletal meat -- 438 CFA F; offals -- 371 CFA F; fat -- 286 CFA F; and bone -- 290 CFA F.¹ The fact that the implicit price of fat in the tas was nearly 300 CFA F per kg strongly suggests that Ivorian consumers desire some fat in their diet.

Factors Limiting the Effective Demand for Fattened Beef

Although consumers in the class 2 market prefer fattier, more tender meat, the degree to which this preference translates into higher prices for well-fed animals is limited by three factors: consumers' dislike for meat that is "too fat," traditional eating habits, and low consumer incomes.

¹See 27, pp.441-44 for details. Because of strong intercorrelation ($r = .85$) between the amount of meat and the amount of bone in the tas, the implicit price of bone was probably overestimated and that of meat underestimated.

Ivorian consumers apparently like some fat in meat, but they complain if beef is "too fat," i.e., if the carcass is covered by a thick layer of fat. Consumers interviewed in Bouaké often cited this as a reason for their not buying imported frozen beef, even though the frozen meat was cheaper than locally slaughtered beef. Traditional eating habits also limit the effective demand for tender meat. Traditionally, meat is consumed in West Africa as part of a sauce that is boiled for several hours. Given this method of preparation, there is little reason to pay a premium for especially tender meat. The effective demand in the class 2 market for tender meat is further limited by the low income of most consumers. Most consumers who buy meat on the class 2 market have little income left to pay a premium for tender meat after meeting their basic needs. Demand for tender meat can be expected to grow, however, as incomes increase. With higher incomes and greater employment possibilities outside the home for women, the opportunity cost of the long time spent preparing meals by traditional methods will increase. Consumers will therefore shift to more rapid means of preparing meat, such as grilling, for which the tenderness of the meat is an important consideration.

What consumers in the class 2 market currently are looking for, then, is meat from a well-fleshed, but not a finished, animal. Butchers who sell on the class 2 market therefore pay slightly more (up to about 7 percent more per kg carcass weight) for animals yielding fattier meat than for lean animals. Effective demand for well-fleshed animals in the class 2 market is probably not high enough, however, to absorb at a premium price all the fattened cattle scheduled to be produced from northern feedlots in the next few years.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The major conclusions and policy recommendations of the study fall under seven headings: 1) the changing Ivorian market for beef; 2) the organization of cattle and meat marketing; 3) market infrastructure needs; 4) problems of transporting cattle; 5) the location of slaughter;

6) the nature of demand for beef in Ivory Coast and the implications of this demand for northern cattle fattening projects; and 7) general recommendations for marketing policy in the future.

The Changing Ivorian Market for Beef

A crucial question facing Ivory Coast and its northern neighbors is the following: during the next few years, how dependent will Ivory Coast be on cattle imports from the Sahelian countries? The question is especially important to the Sahelian countries in light of three recent changes that have reduced the importance of imported cattle as a source of protein in the Ivorian diet:

1) Ivorian consumers have increasingly substituted fish for beef in their diets as the price of beef has risen relative to fish;

2) Ivory Coast's imports of cattle from the Sahelian countries have fallen, and since 1975 they have been replaced in part by imports of frozen beef from non-West African suppliers; and

3) the Ivorian government has launched a series of projects aimed at increasing domestic livestock production (especially poultry and pork production) in order to reduce Ivory Coast's reliance on imports.

In spite of the decreased importance of livestock imports in recent years, Ivory Coast will probably continue to rely on them for a large part of its animal protein supply during the next five years. Prices on the world beef market were usually low during 1975 and 1976, when Ivory Coast first began importing large quantities of frozen beef, and are likely to rise substantially at least through 1980 (27, pp. 447-48). Therefore, even though the Ivorian market for beef is now integrated with the world market, increasing prices for beef on the world market may discourage Ivory Coast from importing beef from non-West African suppliers. The price of fish imported into Ivory Coast is also increasing, and importers contacted in Ivory Coast expected it to continue to increase during the next few years.¹ Therefore, it is unlikely that consumers will

¹Imported frozen fish, which makes up the bulk of Ivory Coast's fish supply, increased in price about 10 percent between 1977 and 1978 (1).

continue to substitute fish for beef in their diets to the degree to which they did between 1970 and 1975. Domestic Ivorian production of poultry and pork has increased in recent years, as has consumption of these substitutes for beef. Per capita consumption of poultry and pork, however, remains much lower than beef consumption, and data on consumer preferences (4) suggest that it would take a large change in relative prices to effect widespread substitution of pork and poultry for beef in the diet. Such changes seem unlikely in the next five to ten years.

Ivory Coast's continued reliance on the Sahelian countries for the bulk of its beef supply has important implications, both for the Sahelian countries and for Ivory Coast itself. The Sahelian countries should realize that Ivory Coast will continue to be an important market for their livestock exports, but not on the same terms as prior to 1975. Ivory Coast has already met many of the fixed costs of importing non-West African frozen meat (e.g., it has contacted exporters, constructed cold storage facilities, and introduced consumers to the product); therefore, it will be relatively easy for Ivory Coast to enter the world market when the world price of beef is below the West African price. It is therefore in the Sahelian countries' interest to facilitate the flow of cattle southward to Ivory Coast (e.g., by improving livestock transport and simplifying export procedures) in order to improve the competitive position of the Sahelian countries vis-à-vis non-West African meat exporters. Ivory Coast will probably remain an important export market for the Sahelian countries, particularly for Mali and Upper Volta, but it is not a market that can be taken for granted.

The world price of beef will probably rise markedly in the next five years; therefore, Ivory Coast's continued reliance on the world market for a large part of its beef supply may prove very costly. It is therefore also in Ivory Coast's interest to facilitate the flow of livestock south from the Sahelian countries, e.g., through improved trekking routes. By making it easier and cheaper for northern livestock merchants to ship their animals south, Ivory Coast can help assure that at least part of the increase in demand for animal protein that will result from the country's population growth, urbanization, and growth in per capita income will translate into an increase in meat consumption, not just an increase in prices.

The Organization of Cattle and Meat Marketing

The research showed that the traditional cattle and meat marketing system is fairly efficient, given the physical infrastructure constraints under which it operates. Market concentration is typically low to moderate, collusion to restrict sales in order to raise prices seems rare, and the profit margins of cattle merchants and butchers do not appear exorbitant. In short, the marketing system for cattle and beef seems to be fairly competitive.

One reason that the market is fairly competitive and net margins are modest is the relative ease of entry into the cattle and meat trades. Since it is fairly easy to enter the trade, there are many buyers and sellers in major markets, and competition among them holds down profit margins. Most plans put forward by government officials for reorganization of the cattle and meat trades involve restricting the number of people involved in the trade, either through strict licensing or by replacing certain market agents by state agencies. While officials may feel that strict licensing requirements would allow the government a higher degree of control over cattle and meat marketing, officials should also realize that by restricting access to the trade, licensing reduces competition and usually leads to higher meat prices. Indeed, the main effect of limiting the number of butchers' licenses issued in Bouaké and Abidjan has been to create a black market in licenses that has made it difficult and expensive for young butchers to enter the trade.

The traditional marketing system is labor-intensive, using little capital other than the cattle sold. Most plans for market reorganization and abattoir improvement involve replacing some of the labor involved in marketing with imported capital equipment. Such plans also would usually disrupt the indigenous training system for butchers and traders. When planning marketing projects, officials should carefully consider the employment effects of these projects. They should also realize that it may not always be appropriate to adopt European or North American models of slaughter and livestock and meat marketing in Ivory Coast because the economic parameters upon which these models are based (e.g., the relative prices of capital and labor) are different in Ivory Coast than in Europe or North America.

Finally, the study has shown that even though butchers in Abidjan and Bouaké ignore official price controls, butchers' net margins are quite low. This implies that the butchers' trade is competitive enough to prevent price-gouging by butchers even without price controls. Removing retail price controls on beef in Abidjan and Bouaké therefore probably would not lead to a rapid increase in prices.

Market Infrastructure Needs

The research showed that much of the market infrastructure provided by recent livestock marketing projects does not contribute to increased market efficiency and usually remains unused by butchers and cattle traders. There are areas, however, where new market infrastructure could contribute substantially to improved cattle and meat marketing. The Abidjan abattoir, for example, is in very poor condition, and rebuilding it would be justified on grounds of both public health and the safety of those who work in it. The lack of grazing space around the Abidjan abattoir and cattle market represents another critical infrastructure constraint to cattle marketing in Ivory Coast. The lack of grazing prevents butchers and cattle merchants from holding a buffer stock of animals as a hedge against supply fluctuations. The lack of a buffer stock combines with irregular arrivals of cattle by rail to result in highly fluctuating supplies in Abidjan and hence highly fluctuating cattle prices. Since Abidjan absorbs about 40 percent of all beef consumed in Ivory Coast (27, p. 58), price instability in Abidjan represents a major problem for cattle merchants and butchers in Ivory Coast. Until the cattle market-abattoir complex in Abidjan is moved to an area with adequate grazing or until means are found to provide forage to the cattle at the present location economically, traders will continue to demand a high risk premium to ship cattle to Abidjan and the high rate of default on debts by Abidjan butchers will likely continue.

In providing new market infrastructure, planners should keep three principles in mind. First, the technology adopted should be in line with local, not overseas, costs of capital and labor. In developed countries capital is relatively cheap and labor is relatively expensive, while in West Africa just the reverse is true. By adopting infrastructure (e.g., abattoirs) designed for price conditions in developed countries, planners in West Africa risk replacing cheap local labor with expensive imported capital. Planners should therefore try, wherever possible, to adapt European or North American infrastructure plans to local price conditions. The second point is that the equipment adopted should be simple and easy to repair. All equipment breaks down eventually, and in general, the more complicated the equipment, the more likely it is to break down, especially given heavy use by relatively untrained personnel. Equipment is most likely to be repaired quickly if parts are available locally at low cost. If expensive spare parts have to be imported, the equipment may be out of service for a long time, leading to serious bottlenecks in marketing or slaughtering. The third point is that it often may be much cheaper to use locally produced, rather than imported materials for infrastructure construction. For example, it may prove cheaper to construct the enclosures in cattle markets with locally produced cement bricks (as was done in Abidjan and Bouaké) than with imported steel pipe (as was done in Man). Use of local materials has the added benefit of generating local employment in the manufacture of these items.

Problems of Cattle Transport

The research showed that trekking is usually the least expensive way of moving cattle within the Sudanese and Guinea savanna regions and that trucking is the most expensive. Trucking is expensive because truck rental rates per animal are high (due to the low weight-to-volume ratio of cattle as compared with other cargoes) and because truckers and merchants are forced to pay substantial unofficial costs en route (e.g., bribes). Therefore, if Ivorian officials want to hold down meat prices in the cities, it would be inadvisable at this time to force merchants

to truck their cattle to market. Merchants, who are quite sensitive to relative transport costs, will shift to long-distance trucking when it becomes profitable for them to do so. The widespread use of trucking within the forest zone indicates that merchants are not opposed to trucking per se; they are only opposed to trucking when more economical means of transport are available. As roads improve and cattle prices rise, the relative profitability of long-distance trucking will increase, leading merchants to ship their cattle by truck.

For the next several years, however, trekking will probably remain the most profitable way of transporting cattle within the savanna zones. Trekking costs could be reduced by the establishment within Ivory Coast of clearly marked cattle trails along which cattle would have right-of-way. Such trails, like those that exist in Upper Volta, would facilitate the flow of cattle southward, reduce the possibility of imported cattle spreading disease to domestic livestock (by restricting imported cattle-specified routes), and lower the incidence of crop damage by trade herds. Trekking losses could be reduced by constructing a few dipping tanks along these trade routes (to reduce weight losses and mortalities resulting from tick-borne diseases) and by providing dry-season watering facilities.

The research showed that the cost of crop damage caused by trade herds is very low when expressed in terms of cost per animal trekked. The problem is that the cost is borne by only a few people, the farmers whose fields are damaged. Although the creation of clearly marked cattle trails in Ivory Coast would reduce the incidence of crop damage, it probably would not eliminate it. One way to handle the problem of compensating farmers for crop damage would be to levy a small tax, e.g., 25 to 30 CFA F per head, on all cattle trekked within the country.¹ The proceeds of this tax would go into a fund administered by the Ministry of Agriculture to compensate farmers whose crops had been damaged by trade herds. Even if the cost of administering the fund were substantial, this solution would be much cheaper for the country than forcing merchants to truck their

¹This tax could be collected by veterinary agents when they issue a health certificate (laissez-passer sanitaire) to the herd.

cattle, the cost of which would be reflected in higher meat prices and seasonal transportation bottlenecks.

Rail transport will continue to be an important means of moving cattle to market, particularly to Abidjan. The cost of shipping cattle by rail, however, is high, especially in terms of the shrinkage and mortality losses en route and the costs of waiting several days in the north for train cars to become available. The RAN should act to reduce the time cattle spend in transit by assuring that trains carrying livestock are given priority over trains carrying other merchandise. The RAN should also consider creating express trains for livestock, either separately or as part of passenger trains. Typically, when cattle are shipped by rail, during much of the time the animals are in the cattle cars, the train is not moving. Three delays are especially important: after the cattle have been loaded in Upper Volta but before the train leaves the station (this delay averages about eight hours in Ouagadougou); at the Voltaic-Ivorian border; and in Abidjan at the Treichville train station, before the cattle are shipped the eight kilometers to the cattle market at Port Bouët (this delay often lasts ten to twelve hours). These delays add significantly to the mortality and weight losses of the cattle during shipment; therefore, the RAN should work with Voltaic and Ivorian customs officials and Abidjan market officials to reduce these delays to a minimum. For example, if the unloading facilities at the Abidjan market were improved and merchants were allowed to pay their RAN bills in advance or as soon as the train arrived in Abidjan, cattle could be unloaded in Abidjan at night, often cutting ten to twelve hours off the time the animals spend in the cattle cars.

In the long run, the RAN should consider replacing its poorly-ventilated cars with open-slatted cattle cars, which would further reduce shrinkage and mortalities en route. The RAN should also study the possibility of feeding and watering cattle en route, either in the cars or at rest stops where the cattle would be unloaded.

The seasonal shortage of rail cars that forces merchants to wait a week or more in the north for cars could be lessened by a change in the RAN's rate structure. If the RAN were to sharply increase the daily rental rate charged for unloaded cars sitting on sidings, merchants who ship

goods north would be induced to unload the cars quickly, leading to a more rapid rotation of these cars. Data presented elsewhere (27, pp. 190-96) indicate that during the 1976-77 the rate of rotation of cars used to ship cattle south was very low, and that a faster rotation of cars could go a long way to reduce the seasonal transportation bottleneck.

The Location of Slaughter

The research showed that given 1977 prices, it was more profitable to ship live animals south for slaughter than to slaughter them in the north and ship their carcasses south. Furthermore, unless large changes occur both in relative transport costs for livestock and meat and in prices of meat and offals in the north and the south, it is likely to remain more profitable to ship live animals south than to ship meat. Planners therefore should not expect much expansion in the chilled meat trade between the north and the south unless they take actions both to reduce transport costs for meat relative to livestock and to change the prices of meat and offals in the north relative to the south.

The model presented in the Appendix shows that the value received for the fifth quarter plays a crucial role in determining the relative profitability of meat versus live animal exports. Unprocessed offals cannot be shipped easily by refrigerated transport, and if there is little demand for them at the point of slaughter, it usually is more profitable to ship the entire animal south, where the price of the fifth quarter is higher, than to slaughter in the north and ship only the carcass south. If planners want to expand the chilled meat trade between the north and south they should therefore take measures that will increase the value of the fifth quarter in the north, e.g., by establishing processing facilities for offals that will allow offals to be exported to areas of high demand. If planners only worry about the problem of "disposing" of the fifth quarter in the north, and not of generating effective demand for offals in order to boost the price of the fifth quarter in the north, it will probably remain more profitable to export live animals to the south than to export meat.

The Nature of Demand for Beef in Ivory Coast: Implications for Fattening Projects

Data collected during the study indicate that production of high quality beef in central West Africa is likely to far exceed demand for this beef by 1980. The profitability of many of the feedlots being established in the area is premised on their ability to sell their animals for a premium on the Ivorian market. The projected supply and demand figures suggest, however, that by 1980 there may be such a surplus of fattened beef on the market that class 1 retailers will not have to pay a premium for this beef. The data show that consumers in the class 2 market prefer fattier, more tender meat, and that the class 2 market could absorb some of the animals from these feedlots. The degree to which the preference of consumers in the class 2 market for fattier, more tender meat will translate into higher prices for these animals, however, will be limited by consumers' dislike of meat that is "too fat," by traditional eating habits, and by low consumer incomes.

The preceding paragraph suggests that some of the fattening projects in the north should be directed away from their current four- to six-month fattening period towards shorter fattening periods aimed at producing well-fleshed, but not fat animals. There is some room for replacing currently imported high quality beef with locally produced beef, but the market for high quality beef is small. The bulk of the beef sold in Ivory Coast will continue to go to the class 2 market, where the demand for higher quality meat is limited. This market could absorb more well-fed animals from short-term (one to three months) fattening schemes, but in planning such programs two points should be kept in mind. First, the projects should be based on a low-cost technology because the class 2 market offers only small premiums for fattened animals. Most of the profit in such projects will have to be made on the weight gain of the animal, not on a premium price paid for higher quality meat. Second, the growth of demand for higher quality meat in class 2 market will be contingent on the growth of per capita incomes in Ivory Coast. Demand for higher quality beef is therefore likely to grow only at a modest pace, and planners should be careful not to expand fattening projects

so fast that the market is flooded with more well-fed cattle than it can absorb at prices that make the fattening projects profitable.

General Considerations to Guide Marketing Policy

An efficient cattle and meat marketing system is one that transforms cattle into meat and distributes the cattle and meat over time and among regions while minimizing the gross marketing margin. By minimizing the cost of performing the tasks of distribution, storage, and transformation, an efficient marketing system benefits both producers and consumers. Producers receive higher prices for their animals and consumers pay lower prices and receive larger quantities of meat than they would with an inefficient marketing system (29, pp. 120-24). Improving market efficiency therefore contributes directly to the stated goal of development policy in Ivory Coast, the improvement of the welfare of the individual.

The problem facing planners and donor agencies in Ivory Coast (and in all of West Africa) is how to reduce the gross marketing margins for cattle and meat in the least costly manner, given the tasks of distribution, storage, and transformation that the marketing system must perform. Two types of solutions have been proposed. The first, typified by the CEBV accords (5), calls for large-scale restructuring of the traditional marketing system, in the hope of assuring more government control over the market. Ghana has gone further than any other country in restructuring the trade, replacing the traditional marketing system with a state monopoly. The other type of solution involves working to relieve the transportation and infrastructure constraints in the current marketing system, in the hope that once these constraints are lessened, competition within the traditional marketing system will drive down gross margins.

The results of this study strongly suggest that the second approach is much more likely to succeed, and in the long run would be much cheaper than trying to totally restructure the marketing system. The research shows that while gross margins in the cattle and meat trades are high,

net margins are modest. This implies that the marketing system is competitive and efficient given the infrastructure and transportation constraints under which it operates. The main reason why gross margins are high is because cattle merchants have high costs (e.g., in terms of mortality and shrinkage losses en route and high export taxes), not because merchants earn monopoly profits.

For the livestock and meat trade to expand in order to meet the needs of Ivory Coast's rapidly growing population, the transportation and infrastructure bottlenecks facing livestock marketing will have to be overcome, whether or not the trade is drastically reorganized. The real question facing Ivory Coast, then, is the following. Should Ivory Coast use its valuable resources (including its scarce veterinary and administrative personnel) to try to totally restructure livestock marketing while at the same time trying to relieve the transportation and infrastructure constraints, or should it concentrate its resources on relieving the transportation and infrastructure constraints, and let the traditional marketing system handle the tasks of distributing cattle and transforming cattle into meat?

Extensive reorganization of the marketing system would involve a very heavy cost in terms of the time of the government personnel who would be called upon to run the new system or enforce the new regulations. It would probably be a more efficient use of government resources for the government to work jointly with traditional cattle traders and butchers, most of whom are highly experienced and have a detailed knowledge of the cattle trade, to develop mutually acceptable improvements in the marketing system, rather than working against these marketing agents in an attempt to completely restructure the trade. Ivory Coast's only attempt to date to set up an alternative cattle marketing system, SODEPRA's Service de Commercialisation, has not been encouraging. Research shows that despite the expenses the state incurred in setting up and running the new marketing agency, the agency did not achieve its primary goal of offering northern Ivorian cattle producers prices that were significantly higher than those offered by traditional merchants (27, pp. 299-302). Certainly Ghana's recent experience with its state cattle marketing agency, the Ghana Meat Marketing

Board, should serve as a warning to planners about the difficulties of trying to replace the traditional marketing system with a state monopoly.

Working with the traditional marketing system does not mean the government will be without a role in cattle and meat marketing. The government has important roles to play in insuring the health of imported and domestically produced animals, safeguarding public health by insuring proper sanitation in the abattoirs, and improving the transportation and market infrastructure for cattle and meat. The government should not use its power, however, to restrict entry into the cattle and meat trades unless there is strong justification, e.g., in terms of maintaining public health. Restricting entry (usually through limiting the number of licenses issued) typically reduces competition, drives up marketing margins, and results in producers receiving lower prices for their animals and consumers paying higher prices for their meat.

A shift in government policy away from trying to totally restructure cattle marketing to an attempt to improve infrastructure and guarantee the competitiveness of the traditional marketing system implies a major change in the way in which livestock marketing projects are designed and implemented. In the past, donor organizations and government planners have typically designed marketing projects without consulting butchers, traders, or intermediaries about these market participants' perceptions of the major problems of cattle and meat marketing. Market participants were usually contacted (if at all) only after the project had been planned, in order to tell them what their new obligations would be as a result of the project. Seldom have planners tried to tap merchants' and butchers' knowledge of the trade when designing projects, nor have they often tried to design projects to respond to what the market participants feel are the major problems of cattle and meat marketing. As a result, many butchers and traders regard the government as an adversary, interested mainly in taxing them to finance projects they feel are unnecessary.

If livestock and meat marketing in Ivory Coast are to be improved efficiently and effectively, there needs to be more contact and two-way communication between market participants and the government officials and donor agencies in charge of planning market improvements. Market

participants should be contacted early in the design stage of projects so that the projects can be modified to respond to what these marketing agents perceive as major problems in the trade. Certainly planners should not feel obligated to do everything the butchers and cattle traders suggest, but it would be equally unwise for planners to totally ignore these market participants when designing projects. Not only do butchers and traders have knowledge of the market that can be extremely useful in designing projects, but by involving the market participants in project design, planners can help assure that butchers and traders will cooperate in project implementation. It is also important that before planners advocate widespread changes in the marketing system, they understand why market participants behave as they do; often behavior that appears irrational at first glance is based firmly on economic principles.

APPENDIX

MEAT VERSUS LIVE ANIMAL SHIPMENTS¹

This appendix presents a model that specifies the conditions under which it is more profitable to slaughter cattle in the north and ship their carcasses south than to ship the cattle south for slaughter. The model shows that the factors that determine whether it is more profitable to slaughter in the north than in the south are:

- (a) shrinkage during shipments of live animals and meat;
- (b) prices of meat and fifth quarter in the north and the south; and
- (c) transfer costs for cattle and meat between the north and the south.

In the analysis it is assumed that the fifth quarters of animals slaughtered in the north are sold in the north and are not shipped south. Typically, slaughterhouses in the north do not export offals (other than hides) because without processing, offals tend to spoil quickly.

The profit from slaughtering an animal in the north and shipping the meat south to Abidjan is given by the equation:

$$M_M = DW_{LN} (1-L_M) P_{MA} + F_N P_{FN} - W_{LN} P_{LN} - C_M \quad (1)$$

$$\left[\begin{array}{l} \text{Margin earned} \\ \text{shipping meat} \end{array} \right] = \left[\begin{array}{l} \text{Receipts from} \\ \text{meat sold in} \\ \text{Abidjan} \end{array} \right] + \left[\begin{array}{l} \text{Receipts from} \\ \text{fifth quarter} \\ \text{sold in north} \end{array} \right] - \left[\begin{array}{l} \text{Purchase price} \\ \text{of animal} \end{array} \right] - \left[\begin{array}{l} \text{Slaughter} \\ \text{and transfer} \\ \text{costs} \end{array} \right]$$

where

M_M = net margin earned in shipping the meat to Abidjan;

D = dressing-out proportion of the animal (the carcass weight divided by the liveweight);

W_{LN} = liveweight of the animal in the north;

L_M = shrinkage of the refrigerated carcass during transit, expressed as a proportion of the original carcass weight;

P_{MA} = wholesale price per kg of meat in Abidjan;

F_N = weight of the fifth quarter in the north;

¹The author is grateful to Edgar Ariza-Nino for help in developing the model presented in this Appendix.

P_{FN} = average price per kg of the fifth quarter in the north;

P_{LN} = price per kg liveweight of the animal in the north; and

C_M = costs of slaughtering the animal in the north and shipping the meat to Abidjan.

Equation (1) states that the margin earned from shipping meat is equal to the value of the meat that arrives in Abidjan [$DW_{LN} (1-L_M) P_{MA}$] plus the value of the fifth quarter sold in the north [$F_N P_{FN}$] minus the purchase price of the animal in the north [$W_{LN} P_{LN}$] and the costs incurred in slaughtering the animal and shipping the carcass to Abidjan [C_M].

Similarly, the profit margin earned by shipping a live animal south to Abidjan is given by the equation:

$$M_L = DW_{LN} (1-L_L) P_{MA} + (1-L_L) F_N P_{FA} - W_{LN} P_{LN} - C_L \quad (2)$$

$$\left[\begin{array}{c} \text{Margin earned} \\ \text{shipping} \\ \text{live animal} \end{array} \right] = \left[\begin{array}{c} \text{Receipts from sale of} \\ \text{animal in Abidjan} \end{array} \right] - \left[\begin{array}{c} \text{Purchase price} \\ \text{of animal} \end{array} \right] - \left[\begin{array}{c} \text{Transfer} \\ \text{costs} \end{array} \right]$$

where

M_L = net margin earned shipping the animal to Abidjan;

L_L = shrinkage of carcass and fifth quarter during shipment to Abidjan, expressed as a proportion of the original weights of the carcass and the fifth quarter [N.B. the percentage shrinkage is assumed to be the same for the carcass and the fifth quarter];

P_{FA} = average price per kg of the fifth quarter in Abidjan;

C_L = transfer cost of exporting the animal to Abidjan; and

D , W_{LN} , P_{MA} , F_N , and P_{LN} are as defined earlier.

Equation 2 states that the margin earned exporting an animal from the north to Abidjan is equal to the amount received in Abidjan for the animal's carcass [$DW_{LN} (1-L_L) P_{MA}$] and for its fifth quarter [$(1-L_L) F_N P_{FA}$]¹ minus the purchase price of the animal in the north [$W_{LN} P_{LN}$] and the costs incurred in exporting the animal to Abidjan [C_L].

It will be more profitable to slaughter in the north and ship the meat to Abidjan than to ship live animals to Abidjan when $M_M - M_L > 0$. Combining equations (1) and (2) it can be shown that:

$$M_M - M_L = DW_{LN} P_{MA} (L_L - L_M) - F_N [P_{FA} (1 - L_L) - P_{FN}] - (C_M - C_L) \quad (3)$$

$$\left[\begin{array}{c} \text{Gain from} \\ \text{slaughter} \\ \text{in north} \end{array} \right] = \left[\begin{array}{c} \text{Gain in meat value} \\ \text{from reduced} \\ \text{shrinkage} \end{array} \right] - \left[\begin{array}{c} \text{Loss in receipts from} \\ \text{fifth quarter} \end{array} \right] - \left[\begin{array}{c} \text{Increase in} \\ \text{slaughter and} \\ \text{transport costs} \end{array} \right]$$

Equation 3 states that the difference between the margins earned shipping meat and shipping live animals depends on three elements. The first, represented by the term $DW_{LN} P_{MA} (L_L - L_M)$, is the value gained due to the reduced amount of carcass shrinkage in meat shipments as compared to live animal shipments. The second element, represented by the term $F_N [P_{FA} (1-L_L) - P_{FN}]$, is the value lost by selling the fifth quarter in the north rather than in Abidjan, where its price is higher. The final element, $C_M - C_L$, is the difference between the per animal transfer costs of chilled carcasses and live animals.

If one assumes that the weight of the fifth quarter is some constant percentage, y , of liveweight (i.e., $F_N = yW_N$), one can state the conditions under which it will be more profitable to ship meat than to ship live animals. Substituting the new assumed value of F_N into equation (3) and letting X equal the ratio of the price of the fifth quarter in

Abidjan to the price of meat in Abidjan (i.e., $X = \frac{P_{FA}}{P_{MA}}$), equation (3)

can be expressed in slightly different terms:

$$M_M - M_L = W_{LN} P_{MA} [D(L_L - L_M) - yX(1 - L_L)] + yW_{LN} P_{FN} + C_L - C_M \quad (3a)$$

¹ In practice, the seller receives a single amount for the live animal that includes both the value of the carcass and the value of the fifth quarter.

Equation 3 will be greater than zero (i.e., it will be more profitable to ship meat than live animals) when:

$$W_{LN} P_{MA} (L_L - L_M) > y W_{LN} [X P_{MA} (1 - L_L) - P_{FN}] + C_M - C_L \quad (4)$$

$$\left[\begin{array}{c} \text{Value of meat "saved"} \\ \text{due to reduced} \\ \text{shrinkage} \end{array} \right] > \left[\begin{array}{c} \text{Receipts foregone by} \\ \text{selling fifth quarter in} \\ \text{north where its price is} \\ \text{lower} \end{array} \right] + \left[\begin{array}{c} \text{Increase in} \\ \text{slaughter and} \\ \text{transport costs} \end{array} \right]$$

Relationship (4) states that it will be more profitable to ship meat than live animals whenever the value of the meat "saved" due to the lower carcass shrinkage involved in meat shipments more than offsets the income foregone in selling the fifth quarter in the north rather than in the south, and the increase in slaughter and transport costs involved in shipping meat as opposed to live animals. Rearranging terms in relationship (4) and dividing through by W_{LN} , the liveweight, leads to the statement that it will be more profitable to ship meat than live animals ($M_M - M_L > 0$) when:

$$P_{FN} > \frac{P_{MA} [yX(1-L_L) - D(L_L - L_M)]}{y} + \frac{\bar{C}_M - \bar{C}_L}{y} \quad (5)$$

where

$\bar{C}_M = \frac{C_M}{W_{LN}}$ = slaughter and transfer costs of meat, expressed in terms of cost per kg. original liveweight; and

$C_L = \frac{C_L}{W_{LN}}$ = per kg. transfer costs of live animals.¹

Relationship 5 states that the relative profitability of exporting meat as opposed to live animals will increase only if one or a combination of the following things happen:

¹Since many of the costs of shipping of both cattle and meat (C_L and C_M) are proportional to the animals' weights (e.g., the number of animals or carcasses shipped per train car depends on their weights), $\bar{C}_L$ and $\bar{C}_M$ vary little with respect to the weight of the animal shipped.

- 1) the price of offals in Abidjan falls relative to the price of meat in Abidjan;
- 2) the average dressing percentage increases;
- 3) the amount of carcass shrinkage during meat shipments falls relative to the carcass shrinkage experienced in shipping live animals;
- 4) the price of the fifth quarter in the producing areas increases relative to the price of meat in Abidjan;
- 5) the costs of slaughtering in the north and transporting carcasses south fall relative to the costs of transporting cattle south.

From a policy perspective, the following factors in relationship (5) are of greatest importance because of their variability and their susceptibility to government policy management:

- 1) the price of meat in Abidjan, P_{MA} ;
- 2) the price of the fifth quarter in the north, P_{FA} ; and
- 3) slaughter and transport costs for cattle and meat, $\bar{C}_L$ and $\bar{C}_M$.

The ratio of the price of offals in Abidjan to the price of meat in Abidjan, X , is also of critical importance, but as explained below, it is likely to remain fairly stable in the next ten to fifteen years, and therefore can be regarded as nearly constant. Similarly, the average dressing percentage, D , is unlikely to change markedly in the coming years.¹ It is also unlikely that L_M , the percentage carcass shrinkage during meat shipments, will fall relative to L_L , the percentage carcass shrinkage during shipments of live animals.²

Before considering the four crucial policy variables, P_{MA} , P_{FN} , $\bar{C}_M$, and $\bar{C}_L$, it is first necessary to explain why X , the offal/meat price ratio in

¹Furthermore, relationship (5) is not very sensitive to changes in D as D takes values from .4 to .6 (the maximum likely range of variation in D).

²There is much more room for reducing carcass shrinkage during cattle shipments than during meat shipments, particularly for cattle shipped by rail. Speeding up transit time (e.g., by reducing the amount of time spent on sidings) could lead to a reduction in weight losses of cattle and would increase the profitability of shipping live animals as opposed to meat. Therefore, in the following analysis, the possibility of lowering shrinkage during meat shipment relative to shrinkage during live animal shipments is ignored.

Abidjan, is likely to remain fairly stable in the near future. The price ratio is a function of consumer preferences and incomes in Abidjan (i.e., the shape of the demand functions for offals and meat in Abidjan), and might be expected to change as incomes and the absolute price of meat change. Data presented elsewhere (27, Chapter 12) indicate a strong consumer preference for meat as opposed to offals; therefore, as real incomes rise, one might expect demand for meat to increase faster than the demand for offals, leading to a decline in X , the offal/meat price ratio. Whether X decreases as incomes rise, however, depends on several factors, including whether consumers of protein other than meat and offals (e.g., fish) begin consuming offals as their incomes rise.¹

¹It can be shown that X will decline as incomes rise when

$$P_{FA} > \frac{F_{FA}}{F_{MA}} \cdot \frac{\eta_{YFA}}{\eta_{YMA}} \cdot P_{MA} \quad (6)$$

where

P_A = original price of offals in Abidjan;

F_{FA} = price flexibility of demand for offals in Abidjan (approximately equal to the inverse of the price elasticity of demand for offals);

F_{MA} = price flexibility of demand for meat in Abidjan;

η_{YFA} = income elasticity of demand for offals in Abidjan;

η_{YMA} = income elasticity of demand for meat in Abidjan; and

P_{MA} = original price of meat in Abidjan.

If, as seems reasonable, $\eta_{YMA} > \eta_{YFA}$, and $|F_{FA}| > |F_{MA}|$, then whether inequality (6) holds depends on the absolute magnitude of these parameters and on the size of P_{MA} and P_{FA} . If, however, as incomes rose, there were a large shift in consumption from fish to offals (i.e., if η_{YFA} were greater than η_{YMA}), then inequality (6) would be unlikely to hold. The experience of developed countries, however, suggest that in the long run, as incomes rise, the offal/meat price ratio falls.

How the offal/meat price ratio, X , will behave as the absolute price of meat in Abidjan increases depends on the size of the own-price elasticity of demand for offals and the cross-price elasticity of offals with respect to meat. If the cross-elasticity is equal to the own-price elasticity, then X will remain unchanged as the price of meat increases. If the cross-elasticity is greater than the own-price elasticity, then X will increase as the price of meat increases.¹ It is likely that in Abidjan the cross-

¹Let P_{MA} = original price of meat in Abidjan;

P_{FA} = original price of offals in Abidjan;

$X = P_{FA}/P_{MA}$

X is unchanged when P_{MA} increases when:

$$\frac{dX}{dP_{MA}} = 0 = \frac{P_{MA} \frac{dP_{FA}}{dP_{MA}} - P_{FA}}{(P_{MA})^2} = \frac{1}{P_{MA}} \left[\frac{dP_{FA}}{dP_{MA}} - \frac{P_{FA}}{P_{MA}} \right] = 0$$

Solving for $\frac{dP_{FA}}{dP_{MA}}$ yields $\frac{dP_{FA}}{dP_{MA}} = \frac{P_{FA}}{P_{MA}}$. Using the chain rule,

$$\frac{dP_{FA}}{dP_{MA}} = \frac{dP_{FA}}{dP_{FA}} \cdot \frac{dQ_{FA}}{dP_{MA}} = \frac{P_{FA}}{P_{MA}}, \quad \text{or} \quad \frac{dQ_{FA}}{dP_{MA}} \cdot \frac{P_{MA}}{P_{FA}} = \frac{1}{\frac{dP_{FA}}{dQ_{FA}}}$$

$$\bullet \bullet \quad \frac{dQ_{FA}}{dP_{MA}} \cdot \frac{P_{MA}}{P_{FA}} \cdot \frac{P_{FA}}{Q_{FA}} = \frac{1}{\frac{dP_{FA}}{dQ_{FA}}} \cdot \frac{P_{FA}}{Q_{FA}}$$

$$\eta_{FMA} \approx \eta_{PFA}$$

where

Q_{FA} = quantity of offals demanded in Abidjan;

η_{FMA} = cross-elasticity of demand for offals with respect to meat in Abidjan; and

η_{PFA} = price elasticity of demand for offals in Abidjan.

If $\eta_{FMA} > \eta_{PFA}$, then $\frac{dX}{dP_{MA}} > 0$, i.e., the offal/meat price ratio increases as the price of meat increases.

elasticity of offals with respect to meat is fairly high because meat purchases represent an important part of consumers' food budgets and as the price of meat increases, consumers shift from buying more preferred to less preferred types of animal protein. For a large part of the Abidjan population, such a shift corresponds to buying more offals and less skeletal meat. If this shift were large enough (i.e., if the cross-elasticity were high enough) the offal/meat price ratio could even increase as the price of meat increases.

The preceding discussion suggests that in the near future, decreases in the offal/meat price ratio due to income effects may be offset by increases in the ratio due to price effects. In the following analysis, X (the price ratio) is taken as a constant, although later it is allowed to vary.

If shrinkage during transit, dressing percentages, and the offal/meat price ratio in Abidjan remain unchanged, the future profitability of the meat trade compared with the live animal trade will depend only on changes in the wholesale price of meat in Abidjan (P_{MA}), the wholesale price of the fifth quarter in the producing regions (P_{FN}), and the relative transfer costs ($\bar{C}_M$ and $\bar{C}_L$). Relationship 5 states that given transfer costs, if the price of offals in the exporting region exceeds a certain percentage of the price of meat in Abidjan, it becomes profitable to export meat. If the price of the fifth quarter in the north is fairly high relative to the Abidjan price, the merchant loses comparatively little by selling the fifth quarter in the north rather than shipping it on to Abidjan (in the form of a live animal) where its price is higher. He more than makes up this loss by the meat he "saves" due to the lower carcass shrinkage in meat shipments. Relationship 5 further states that if meat prices in Abidjan increase relative to fifth quarter prices in the producing areas and the offal/meat price ratio in Abidjan remains unchanged, it becomes less, not more, profitable to ship meat south. As the meat price in Abidjan rises, so does the price of the fifth quarter in Abidjan, and it becomes increasingly profitable to send both the meat and the fifth quarter south in the form of live animals. Relationship 5 implies that unless means are found to increase the demand for fifth quarter products in the producing areas (e.g., through processing and export of offals) expansion of meat exports from these areas

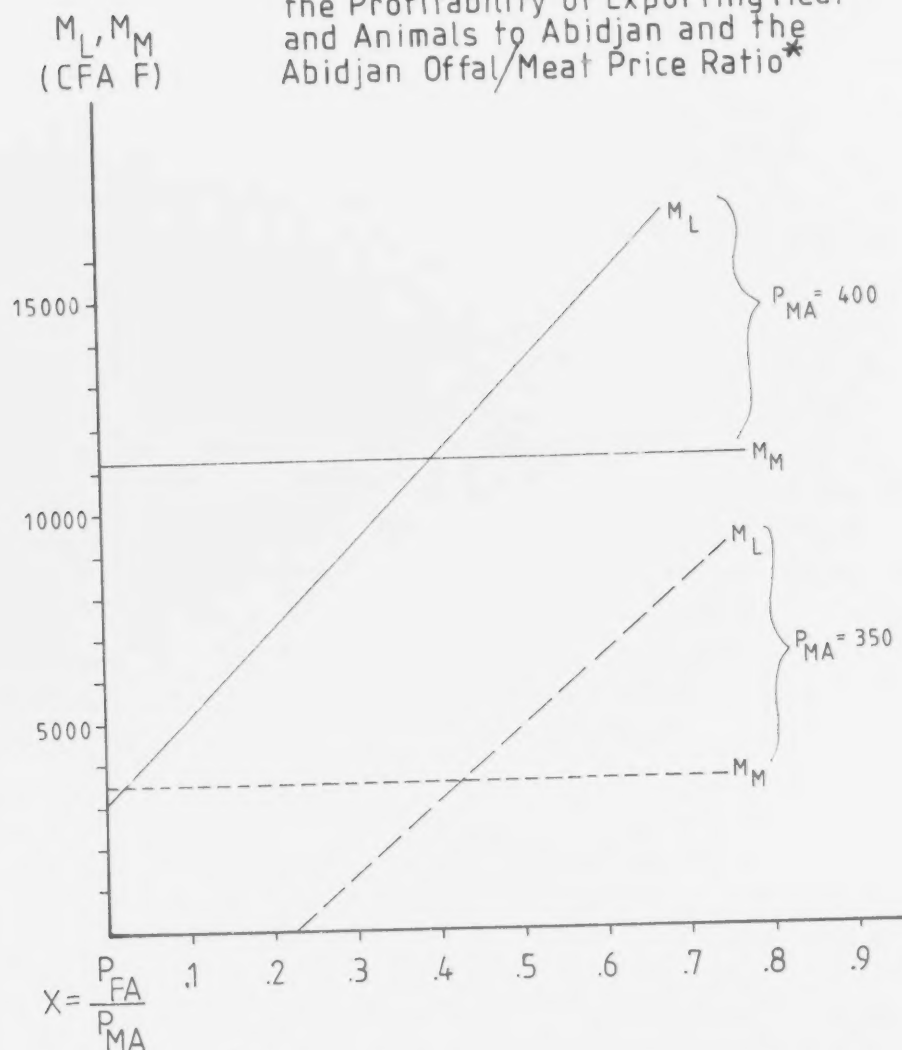
may be self-braking. Expanding slaughter in order to export meat from the producing zones will lead to increased supplies of offals in these areas. Without an increase in demand for fifth quarter in the producing areas, the price of the fifth quarter there will fall relative to Abidjan, and the profitability of live animal shipments relative to meat shipments will increase.¹

The absolute profitability of meat shipments depends on the price of meat in Abidjan compared to the price of meat in the north. The relative profitability of meat versus live animal shipments, however, depends not only on relative prices in the north and the south, but also on the ratio of the price of offals in Abidjan to the price of meat in Abidjan. This is shown in Figure 1, which shows how the margins earned shipping meat and live animals to Abidjan, M_M and M_L , vary as X , the Abidjan offal/meat price ratio varies. Figure 1 is drawn using the values for D , L_L , L_M , and y corresponding to cattle and beef shipped from Ouagadougou to Abidjan by rail in early 1977 (namely $D = .49$, $L_L = .09$, $L_M = .04$, $= .55$, and $y = .175$), and assuming two different meat prices in Abidjan.² In both cases, when (the Abidjan offal/meat price ratio), exceeds about .4, it becomes more profitable to ship live cattle than to ship meat. In early 1977, X was about .55; therefore, little chilled meat was shipped to Abidjan from the north. Given the prices in early 1977, it was only profitable to ship high quality meat from the north to Abidjan. High income consumers in Abidjan paid a premium for this meat, therefore the offal/meat price ratio for this meat

¹Expanded meat shipments to Abidjan would also increase the supply of meat relative to the supply of offals in Abidjan, leading to an increase in the offal/meat price ratio in Abidjan. This would further increase the relative profitability of shipping live animals rather than meat.

²See 27, p. 267 for details of how these values for D , L_L , L_M , X and y were calculated. A constant cattle price of 250 CFA F per kg carcass weight is assumed for Ouagadougou, so the two different prices shown in Abidjan represent two different relative north-south prices.

FIGURE 1: Relationship Between the Profitability of Exporting Meat and Animals to Abidjan and the Abidjan Offal/Meat Price Ratio*



* $X = \frac{P_{FA}}{P_{MA}}$ where P_{MA} = wholesale price of beef in Abidjan

P_{FA} = wholesale price of the fifth quarter (offals) in Abidjan

M_M = margin earned exporting meat to Abidjan

M_L = margin earned exporting live animals to Abidjan

The figure is drawn using the parameters described in the text and assuming a cattle price in the north of 250 CFA F per kg. carcass weight.

was low.¹ For ordinary quality meat no premium was paid, and the only way in which shipments of ordinary quality meat could have become more profitable than shipments of live animals given the prevailing prices would have been for changes to occur in the relative transfer costs (C_M and C_L) or in the shrinkage rates for meat and live animals (L_M and L_L).

Three policy implications follow from this discussion. First, given current prices, exporting meat from the north will remain less profitable than exporting live animals unless processing and transportation costs for meat and shrinkage of meat en route (C_M and L_M) fall relative to transportation costs and shrinkage for live animals (C_L and L_L). Second, an increase in the price of meat in Abidjan alone will not make it more profitable to ship meat than to ship live animals. In fact, if the price of meat and fifth quarter in Abidjan rises relative to the price of the fifth quarter in the north, the profitability of shipping chilled meat will decline relative to that of shipping live animals. Third, the value of the fifth quarter plays a crucial role in determining whether it is more profitable to ship live animals or meat. For meat exports to become and remain more profitable than shipments of live animals, not only must transportation costs for meat decline relative to those for animals, but means must also be found to increase the demand for the fifth quarter in the north. Processing and export of offals may be one way of doing this.

¹ Stated another way, it was profitable to ship high quality meat because the value of the meat "saved" because of reduced shrinkage in carcass shipments was very high, and more than offset the loss incurred in selling the fifth quarter in the north where its price was lower than in Abidjan.

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